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ABSTRACT

A study investigated time factors in two-person telephone conversations, in which visual clues were absent. The lengths and occurrences of vocalizations, pauses, turns, switching pauses, and simultaneous speech were measured with the aid of a computer program. The timing patterns of three conversation types were compared: two Finns speaking in Finnish; two Americans speaking in English; and a Finn and an American speaking in English. Clear differences were found between the two kinds of same-culture conversation: Finns allowed more numerous and longer switching pauses and thereby tolerated more silence, whereas Americans vocalized more and used shorter switching pauses. The differences diminished in the intercultural conversation, with adaptation more obvious for the Finns than the Americans. Simultaneous speech was very common in the two-culture conversations, with Finns speaking during the Americans' turns. This is interpreted as a possible symptom of a malfunctioning turn-taking mechanism and also a possible result of increased use of mistimed back-channel. It was also concluded that the computer analysis method can be useful in examining conversation timing. (MSE)

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ASSESSMENT OF CHRONOGRAPHY IN FINNISH-ENGLISH TELEPHONE CONVERSATION: AN ATTEMPT AT A COMPUTER ANALYSIS

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ABSTRACT

This study investigates conversation chronography in dyadic conversations where visual clues are denied. The lengths and occurrences of vocalizations, pauses, turns, switching pauses and simultaneous speech are measured with the help of a computer application developed for this purpose., the Automatic Conversation Timing System (ACTS). The chronographic patterning of three types of telephone conversation is compared: Finns talking to each other in Finnish, Americans talking to each other in English, and intercultural conversation between Finns and Americans in English. Additionally, description and evaluation is provided of the computer method developed.

Clear differences were found between the two intracultural groups of conversations. Finns allowed more numerous and longer switching pauses and thereby tolerated more silence, whereas Americans vocalized more and took the turn after a shorter switching pause. Probably due to accommodation to the other speaker's rhythmic patterning, the differences diminished in intercultural conversation. Adaptation was more obvious for Finns than for Americans. The portion of simultaneous speech was strikingly high in intercultural conversations: Finns spoke during their American partner's turn. This is interpreted partly as a possible symptom of the malfunctioning of the turn-taking mechanism and partly as a result of increased use of mistimed back-channel.

The study shows that a computer-based conversation chronography analysis method can be used as a tool to reveal differences in conversation timing. The reliability of the ACTS is shown to be good.

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1. INTRODUCTION

During the last twenty years, pausology -- the study of the use of silence in speech -- has been regarded as one of the few ways of "measuring speech" objectively. Pauses are assumed to reveal something about how ideas are processed into linguistic form. Pausological measurements have traditionally been made from text readings or narratives by means of recording, manual or instrumental measurement, and transcription.

A more recent development is the measurement of pauses from conversation, which is the undeniably most natural and frequent use of language. Language is said to largely reflect the way any individual thinks; any differences -- whether they be of sociodemographic or psychological origin -- can be traced and evaluated. Chronographical study of conversation casts light upon how discussion is structured temporally as well as upon the speakers' behavior and cognition. This again can help to unravel the mysteries of various cultural aspects of communicative competence.

Recently, researchers' attitudes toward silence have changed (see eg. Tannen and Saville-Troike (eds.) 1985). Silence is no longer seen merely as lack of speech. It can be seen to have a function of its own. Silence, it is claimed, reflects, among other things, cultural differences. Studies on silence have shown that the use and tolerance of silence varies from one culture to another. On the arbitrary scale of silent - non-silent, "Silent Finns" are often regarded to be located toward the silent end, whereas Americans, for instance, are considered to be closer to the non-silent end. If there is a difference, it should become evident through the analysis of conversation chronography. If differences are found to exist, their relative magnitude could indicate how serious an obstacle they are to communication. This again could enable speculation of what can be done to alleviate the possible problem.

The analysis of the temporal structure of conversation raises a number of problems. First, the amount of data resulting from even a short excerpt of conversation is so overwhelming that no human being can evaluate, let alone measure, the parameters in real time. Second, it has been shown that people hear what they expect to hear: there is a vast gap between the physical reality and anyone's conception of what happens. This means that it is next to impossible for a person to objectively estimate phenomena such as pauses that occur in speech, since what is said affects how it is heard. Third, instrumental methods of analyzing conversation chronography are slow and tedious: the sheer amount of paper produced by an ink jet plotter for a relatively accurate analysis of pauses in a ten-minute conversation is immense: with a paper speed of 10 cm/s, 60 metres of paper is produced, from which the chronography parameters still need to be manually measured by means of a ruler!

The solution applied in this study is based on the use of a computer. If the parameters are carefully selected, a computer can carry out all the tedious tasks, which gives the more researcher time for relevant things, such as analyzing the results. It is clear that the use of a computer sets restrictions on the selection of parameters that can be measured. The most apparent one, of course, is that semantics cannot be involved. This, however, need not be a severe handicap, as has been shown by earlier attempts at automation (see e.g. Jaffe and Feldstein 1970). The measurement, when carried out by a computer, is objective as regards physical reality -- pauses are found where they exist, not where they are logically expected to be. Even if a small personal computer is used, the process of extracting a number of parameters takes only a fraction of the time needed for transcription and manual measurent. Furthermore, a computer-based solution makes it possible to analyze data almost in real time.

The objectives of this study can be stated as follows: First, this study aims at measuring possible differences in conversation chronography between two culturally different groups, Finns and Americans. To simplify the analysis, all visual clues have been eliminated: the conversations were conducted via telephone. To provide adequate data for comparison, both nationality groups engaged in intercultural as well as intracultural conversations. In intracultural conversations, Finns spoke Finnish and Americans spoke English. In intercultural conversations, English was spoken.

Second, this work aims at developing an automatic, computer-based system for the analysis of conversation chronography. This system was used and tested in the processing of the conversations. The results of the measurement of each conversation were then analyzed using standard methods available for statistical analysis. Although the present study involves only dyadic conversations, the system is designed to facilitate the analysis of four speakers. The theoretical framework for the definition of the parameters is included but, although the task of programming the computer is far from being trivial, no emphasis is placed on the description of the software and hardware of the system.

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2. THEORETICAL FRAMEWORK AND DEFINITIONS

One of the earliest attempts to characterize behavior in interpersonal communication through empirical measurement was Norwine's and Murphy's study of telephonic conversation (1938), in which they defined a number of time domain parameters present in dyadic conversation. In psychologically oriented studies, interpersonal communication was characterized through the length of activity periods, or actions, as Chapple and Lindeman (1942) call them. The frequency and time-related patterning of verbal and non-verbal interaction was shown to be predictive of an individual's behavior in other interactive situations as well as of the behavior of whole cultural groups (Matarazzo et al. 1956; Arensburg 1972). Frequency and duration of interactive actions were claimed to provide quantitative indices of interactive performance.

From the mid-fifties to the early seventies the emphasis seems to have been on linguistic rather than physically measurable phenomena -- the content and nature of communication was studied. Bales (1950) created a widely used fully systematic categorization method for the study of interaction. Since the early seventies, physical measurements introduced in the fields of psychophysiology and phonetics have been modified for use in quantitative analysis of interpersonal communication. Anthropological and ethnological sciences were interdisciplinarily combined with psychology, sociology, linguistics, phonetics and speech science. This interdisciplinary approach has proved to be especially fruitful in the study of intercultural communication, which is a complicated task due to the number of factors involved.

In 1975, Kendon pointed out (Kendon et al. (eds.) 1975:11) that terminology in this field of study had not yet stabilized; even fundamental terms, such as 'conversation' and 'turn' were "fraught with ambiguity." It will become evident in the following theoretical discussion that this is still the case: even though a generally acceptable terminology has been formed in the course of years, there are still several alternative views as to how even the most fundamental terms should be defined.

2.1. Conversation Chronography as an Index to Culture

> To a great extent, our language is a product of our culture. At the same time, our culture is very much a product of our language. Culture and language are inseparable. (Applbaum & al. 1973:99)

The above quotation reflects a view according to which language is claimed to set the boundaries of human thinking. A less radical version of this view is largely accepted today, as cross-linguistic studies have shown (see, for instance, Gudykunst 1985). Furthermore, it is claimed that the variables for intercultural and intracultural communication are the same (Gudykunst 1985:270). According to Gudykunst, these variables include facial expressions, body movements, speaker-to-speaker distance, and gaze and timing parameters, such as pausing.

According to Applbaum et al. (1973:93), intercultural communication depends on the ability of participants to share social perceptions. Goldman-Eisler (1968) and Scollon & Scollon (1981; 1983) have gone further towards psychology and sociology as they show that, in addition to the cognitive view of the world and its phenomena, the communicator's patterns -- communicative behavior -- contribute to the success of communication. Patterns of communication have been shown to be in many cases culture-specific or social group specific. It has become generally accepted in recent years that a communicator's cultural background affects his communicative behavior.

Parks (1985) distinguishes psychological variables from sociodemographic ones. In the former group he sees variables such as self-monitoring, extraversion/introversion, dominance/ submissiveness, reticence and anxiety. The latter group consists of variables such as age, sex, socioeconomic status (SES), race and culture. Studies have shown that each of these variables contributes to the communication behavior of an individual, and in particular a subset of it, vocal behavior, ie. characteristics of the spoken word independent of the verbal or meaning component. These characteristics include vocalization duration, switching pauses, utterance length, pause duration, pitch and intensity. (Parks, 1985:171-204)

The effect of sociodemographic variables on communication has been studied keenly since the early 1970's by sociolinguists (see eg. Trudgill 1974) and speech researchers (see eg. Duncan 1972). Communicational differences between various social groups have been studied by, for instance, Bernstein (1962), Bassett, O'Connell and Monahan (1979), Bassett and O'Connell (1978) and Brotherton (1979). These studies support the idea that there are significant differences, for instance, in the use of pauses. These differences have a tendency to diminish in the course of time as a result of accommodation to the behavior of the other group.

The influence of age and education has been studied, for example, by Sabin, Clemmer, O'Connell and Kowal (1979). Their study suggests that maturity brings about the ability to speak and think simultaneously (1979:[illegible]). The findings of Kowal & al. (1979:47) indicate that with age the number and length of pauses diminishes, and with increased education the placing of the pauses changes from within syntactic units to between them. These conclusions were reached on the basis of pauses measured in reading as well as in free speech (monologue).

Whether sex influences conversation chronography is open to debate. Studies have provided contradictory results, for instance, as to whether women take longer speaking turns than men. Vrugt and Kerkstra (1984:27) suggest that common conceptions of the relationships between men and women may affect the duration of turns. As regards interruptions, the differences are more obvious. Most studies show that men interrupt more than women; if the partner is of the same sex, both men and women interrupt equally often; in mixed interactions, women interrupt about as often as in single-sex interactions (\ ugt and Kerkstra 1984:26-27).

Since the number of the subjects of the present study is small (four Finns, four Americans) and the study has a preliminary, method-testing-oriented nature, sociodemographic variables in general can not be taken into account. An attempt is made to select the subjects so that the groups will be homogeneous as regards sociodemographic variables. Any differences which appear in the results are assumed to be due to one sociodemographic variable, which is culture.

Conversation -- "a sequence of sounds and silences generated by two (or more) interacting speakers" (Jaffe and Feldstein 1970:19) -- is the most typical use of natural language. The study of conversation yields information on language as well as on the interlocutors' backgrounds and culture, among other things. It can be stated as a simplification that conversation always implies a setting (where it happens), time (when it happens), participants (who are involved in the conversation) and topic (what the conversation is about). This description does not take into account the dynamic nature of conversation. Conversation should be seen as an ever-varying process whose outcome cannot reliably be prognosticated: conversation is not an easily predictable set of actions. Yet, some general tendencies, or probabilities, can be stated:

- **Speakers do not normally speak simultaneously but take turns**

- **Turns are limited in length**

- **The flow of speech is not unbroken but consists of vocalization and pauses**

- **Turns, vocalization and pauses all have a measurable duration.**

Scollon and Scollon (1981) have studied the differences in conversation chronography between Athabaskan Indians and Canadians. Canadians considered Athabaskans as sullen, unwilling to speak -- even mentally dull. One of the major findings of their study is that there is a significant difference in the length of switching pauses between these two cultures. Athabaskans allow the other speaker to have longer pauses without taking the turn. The measured 0.5 second difference in switching pause length caused misunderstandings and difficulties in communication: an English speaker thinks the Athabaskan wants to keep silent or has nothing to say; the

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Athabaskan thinks the English speaker speaks too much, does not give others a chance to talk and always interrupts. (Scollon and Scollon 1981:22-36. See Table 1.)

Table 1. What Athabaskans and English speakers find confusing in interethnic communication. (Selected items from a list given in Scollon and Scollon 1981:36)

What's confusing to English speakers about Athabaskans	What's confusing to Athabaskans about English speakers
They do not speak	They talk too much
They keep silent	They always talk first
They avoid situations of talking	They talk to strangers or people they don't know
They never start a conversation	They always interrupt
They are slow to take a turn in talking	They don't give others a chance to talk

In a comprehensive survey of the literature Cappella (1985:393-438) concludes that regularities exist in the sequencing of conversational events. Furthermore, the communication behavior of one speaker affects that of the other speaker. For instance, increases in speech rate by one party tend to increase the partner's speech rate. Such adaptation or accommodation to the communicational style of the partner is often regarded as a form of 'mutual influence'. Reciprocity -- emphasizing personal or cultural peculiarities -- is another form of mutual influence. The evidence for these two phenomena is overwhelming (see eg. Webb 1972, Cappella and Planalp 1981, Jaffe and Feldstein 1970, Welkowitz, Cariffe and Feldstein 1976).

Communication strategies -- potentially conscious plans for solving what to an individual presents itself as a problem in reaching a particular communicative goal (Faerch and Kasper 1983:36) -- are coined assumptions of how the process of communicating is initiated and carried out. When applied to the usage of the second language (L2), a communication strategy can be defined as "a conscious attempt to communicate the learner's thought when the interlanguage structures are inadequate to convey that thought" (Tarone 1983:63). Interlanguage is seen as the state of L2 that is somewhere on the continuum from L1 to the target language.

Faerch and Kasper (1983) classify communication strategies into three types according to the type of behavior that lies in the background. Formal reduction strategies result from either the learner's wish to avoid producing non-fluent or incorrect utterances in interlanguage, or from the native

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speaker's decision to use a simplified subset of L1 in order that non-native speakers understand him. In either case, the speaker avoids using some forms of the spoken language.

Functional reduction strategies refer to situations where the speaker 'reduces' his communicative goal in order to assure at least partial understanding. Achievement strategies mean expanding rather than reducing the speaker's communicative goal. Figure 1 shows an overview of the major types of communication strategies. Communication stategies are of value to the present study only in the role of possible explanatory variables if apparent differences are found between the conversation chronography of Finn-Finn and Finn-American conversations. Therefore, no detailed descriptions of specific strategies are included.

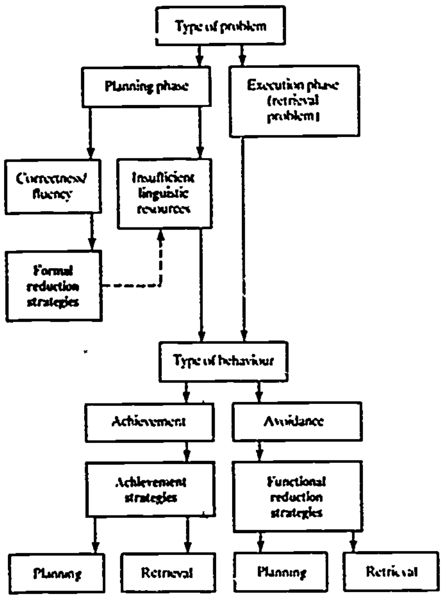

Figure 1. Overview of major types of communication strategies (from Faerch and Kasper 1983:39).

Lehtonen and Sajavaara (1985) propose that there are three typical interaction strategies which Finns employ in cross-cultural conversation: active participation, silent participation, and entire withdrawal. The latter two may result in a negative evaluation of the communicator image of Finns. Even the first strategy may mean delayed turn-taking, slow speech and other

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properties often related to poor communicative competence. In Finnish, back-channel utterances are not frequently used; interruptions are not normally tolerated. Lehtonen (1979) has shown that when speaking Finnish Finns do not have a significantly different pause percentage (41%) from that of speakers of English (39%). These results apply to free narrative. Time and tempo are relative to the speaker's/listener's own standards, which again may vary according to situation and context.

In the discussion above the term 'communicative competence' has occurred a number of times. This term has been defined in numerous ways, depending on the viewpoint. Parks (1985) notes that communicative competence stems from a desire to change, or control, one's environment. Furthermore, he suggests that competence may be understood as including both cognition and behavior; one must know how to do something and then do it (Parks 1985:171-174). Parks promotes the following definition:

Communicative competence represents the degree to which individuals perceive they have satisfied their goals in a given social situation without jeopardizing their ability or opportunity to pursue their other subjectively more important goals. (Parks 1985:175)

This view emphasizes the importance of communicative competence as a tool; it is a means through which an individual can manipulate his environment. Parks distinguishes between a great number of different levels of communicative competence. Sequence control, sensation and intensity control are the levels that involve verbal abilities. In Parks's hierarchy of levels of communicative competence, these are the lowest (Parks 1985:177).

Wiens, Manuagh and Matarazzo (1976) have studied the speech and silence behavior of bilinguals in order to cast light on whether bilinguals store the words of the two languages in a common memory pool, or as separate, language specific libraries. The languages involved in the dyadic conversations were English and German; the twenty subjects were all males, most of them university students or teachers. The study used three speech measures: mean duration of utterance, mean reaction time latency and percentage of interruption. The results suggest that bilinguals appear to select the words they use from two discernible pools, which have a considerable degree of overlap. This conclusion was drawn mainly on the basis of the fact that the results did not show significant differences between languages: conversation chronography did not seem to depend on the language used (Wiens, Manuagh and Matarazzo 1976:79-93).

Lehtonen (1979) has shown that the difference in average percentage of pause time between native Finns speaking Finnish and native Americans speaking English is small (1%). If, as the tests mentioned above indicate, conversation chronography is relatively independent of the language used, then all differences must be due to the speakers' own personal qualities and thus to their culture. Further, if the groups of subjects are relatively homogeneous -- as to some extent is the case in the present study -- possible differences can perhaps be explained mainly on the basis of culture. Lehtonen

(1979) states that individual differences are great. If the individual differences were smaller than the differences between different cultural groups, it could be concluded that there exist cultural differences in conversation chronography exist.

2.2. Definition of the Parameters of Conversation Chronography

To study conversation chronography, we need to decide which parameters to measure, how to define the parameters theoretically so that the results of the measurements can be linked to the theory and, finally, how to define them operationally so that they can be explicitly measured. To establish the parameters needed for quantitative analysis of conversation, a brief look at the time-relatedness of natural conversation is necessary. Figure 2 shows an excerpt from a recorded telephone conversation. The actual speech signal is fed through an amplifier to an ink jet oscillograph. The selected paper speed -- only 50 mm/s -- causes speech to appear 'compressed' on the time axis. Therefore, it is easy to visualize the vocalizations of each speaker.

The curves in Figure 2 show a number of things that are of importance for the present study. First of all, they show that not all sounds are equally distinguishable from the background noise level. For instance, during the occlusion phase of stops such as /k,t,p/ there is only silence; yet, these gaps in vocalization should not be counted as pauses. If we disregard such 'virtual pauses', that shortest pauses that remain tend to be on the order of 250 milliseconds. The occlusion in /white guy/ is approximately 200 milliseconds long. This means that some arbitrary lower limit needs to be set for the duration of a pause. Kowal, O'Connell and Sabin (1975:198) used a limit of 270 ms. Lehtonen and Sajavaara (1980:70) used a limit of 200 milliseconds.

Second, we can see that the speakers in Figure 2 tend to speak in turns. However, as the time section 15.0 - 16.5 seconds shows, they do not always succeed in taking turns. At 15.0 seconds, while speaker 2 is describing a cartoon frame, speaker 1 can be seen forming her own image of the picture: speaker 1 says aloud what she assumes speaker 2 to be going to say. When the speakers say /the target/ they speak simultaneously for 0.5 seconds.

The third finding is that when one speaker makes a longer break, the other speaker starts to speak. For instance, at 10.5 seconds, speaker 2 says /Hmm/ but does not continue. After one second of silence, speaker 1 prompts him with /And then...?/. After almost another 0.7 seconds of silence, speaker 1 decides to start further prompting. However, speaker 2 is ready to continue speaking at the same time, which results in simultaneous speech. Speaker 1 leaves her prompt unfinished in order to let speaker 2 continue. The existence and length of these pauses between two different speakers' vocalizations are obviously of importance.

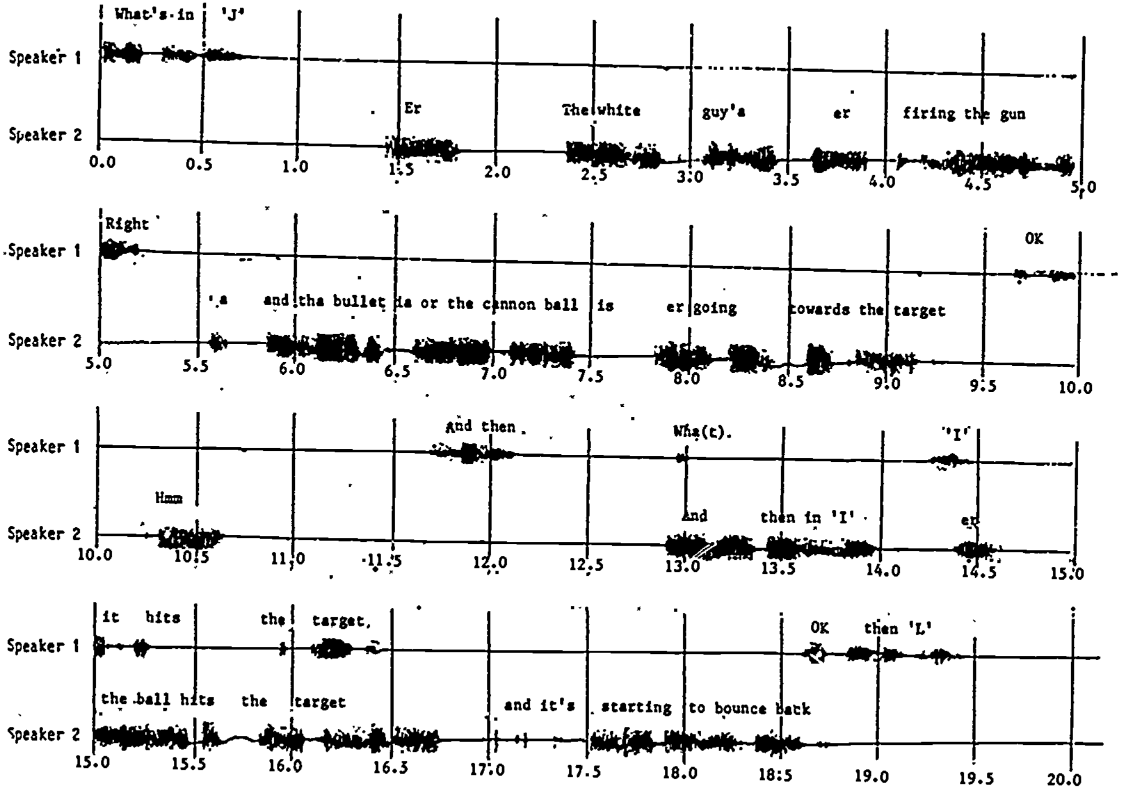

Figure 2. Excerpt of dyadic conversation.

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A number of phenomena that occur in conversation have emerged in the above discussion: vocalization, pause, turn, switching pause and simultaneous speech. In the present study, these are chosen as the parameters of conversation chronography. In the following sections each of these categories will be discussed in more detail.

2.2.1. Vocalization

According to Harris and Rubinstein (1975:257), vocalization means giving words speed, loudness and tonality, ie. giving words a physical form. Verbalization is seen as a more complete form of vocalization: it is possible to vocalize without verbalizing but not verbalize without vocalizing. An example of verbalization would be to say telephone; vocalization includes utterances such as Hmm which are clearly not words. Applbaum & al. (1973:118-119) define vocalization as "those cues transmitted by voice that are not part of the language or code system".

The above two theoretical definitions of vocalization represent two different views of the phenomena. The combination of these views yields a broader definition of vocalization presented by Jaffe and Feldstein (1970:19): "A vocalization is a segment of sound (speech) uninterrupted by any discernible silence and uttered by the speaker who has the turn (or floor), and it is credited to him/her." This operational definition is further developed to suit the needs of this study:

(Def. 1) Vocalization is a segment of sound uninterrupted by pauses (see definition 2). Vocalization is credited to whoever speaks.

This approach to vocalization broadens the use of this parameter as an index to the total activity of a speaker, since all utterances -- whether the person has the turn or not -- are counted as vocalization. Because of the unorthodoxy of this definition, the results of the measurements will not be directly comparable to the ones presented by Jaffe and Feldstein (1970). However, the differences in the results should be fairly small, since the only difference in the definitions is that Jaffe and Feldstein did not count simultaneous speech as vocalization. The percentage of simultaneous speech is usually very low (0.5 % to 5 % of the total conversation time), and thus the difference in the vocalization percentages should be negligible.

Terms which come close to vocalization are 'speech chunk,' 'utterance length' and 'length of run.' Goldman-Eisler (1980:143) has defined 'chunks of speech' as "continuous vocal sequences sandwiched between two pauses." Thus, her definition of the term comes very close to what is called 'vocalization' here. Goldman-Eisler (1979:212) mentions the term 'phonation' when she speaks of phonation/pause ratio. From the phonetic point of view, phonation refers to "'producing sounds' or vulgarly 'vocalization'" (A Grand

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Dictionary of Phonetics 1981:416). Thus, vocalization could be said to be any sounds -- voiced or voiceless -- produced in speech. Raupach (1980:40) defines 'Phonation-Time Ratio' as "the time spent articulating during an utterance." It should be made clear at this point, that most apparata designed to detect speech react only to voiced sounds, and thus, in many cases the term 'phonation' refers to voiced vocalization.

'Utterance length' is a slightly more complex term. Orestr l m (1983:23) differentiates between two types of utterances: speaking turns and back-channel items. Apparently, utterance then includes all pauses that are within it. Mean utterance length, measured often in number of words or syllables instead of milliseconds, provides information on the syntactic complexity of the utterance. Due to the difficulty in automatic word counting and to the fruitlessness of knowledge of utterance complexity as regards this study, the term utterance is not used nor measured in any way. 'Length of run' as defined by Raupach (1980:40) means the speech that occurs between two pauses, and is measured in syllables. As mentioned earlier, no word or syllable counts are done in this study.

2.2.2. Pause

Of all the chronological variables of speech, pause was the first one to be explicitly measured and it is probably still the one most thoroughly studied. Goldman-Eisler (1956; 1968; 1979) has measured pauses in spontaneous speech and conversation. As Saville-Troike (1985:15) points out, most research on silence is devoted to pauses within discourse. Much research has been done in pausology of text reading (see eg. free narrative monologue: Scollon and Scollon 1981; Cappella and Planalp 1981) and pauses on turn boundary (see eg. Jaffe and Feldstein 1970). Less frequently studied are longer (awkward) silences (see eg. McLaughlin and Cody 1982).

It is necessary to make a distinction between pause and silence. Pauses are generally regarded as short silences. The first question is whether the time spent listening to the other speaker should be counted as pause, silence or something else. To begin with, handling this as pause is not very descriptive: a parameter referring to the pauses within each speaker's turns is needed to provide information on fluency. Silence, taken literally, means "absence of sound or voice" (Webster's 1981:1072). The question remains whether there is silence when someone (the subject tested) does not speak, or only when no-one speaks. In the present study, silence is taken to mean moments when nothing is said. This means that silence has subcategories as will become evident when the remaining parameters are defined.

Jaffe and Feldstein (1970:19) have defined pause as

> ... an interval of joint silence bounded by the vocalizations of the speaker who has the turn, and is therefore credited to him/her. (Jaffe and Feldstein, 1970:19)

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This is a simple, yet much used definition of pause. It is quite applicable for the purposes of the present study, if a threshold time - the minimum length of a pause - is specified. Inclusion of a threshold time yields the following definition:

(Def. 2) **Pause is an interval of joint silence in excess of 250 milliseconds, bounded by the vocalizations of the speaker who has the turn.**

A minimum length of 250 milliseconds was chosen, so that stops or other consonantal sequencies, such as in got to and paikka, would not be counted as pause. This time limit is, of course, at least partially arbitrary, but studies in pausology have shown that this limit serves the purpose adequately (see eg. Goldman-Eisler 1956). Threshold time has traditionally ranged from 200 to 330 ms.

Many researchers divide pauses into silent, or unfilled, pauses and filled pauses. By definition, silent pauses are pauses where nothing is said. Filled pauses are either periods of time when there is vocalization without verbalization, or pause fillers, such as you know. In the excerpt presented in Figure 3, er occurring at 1.5, 3.7, 8.0 and 14.5 seconds would be examples of filled pauses of the first type. According to Stenström (forthcoming), the percentual occurrence of filled pauses is only 3% of the total number of pauses. Although the figure presented by Stenström is unquestionably speaker-specific and cannot therefore be generalized, it could be argued that the method for identifying pauses used in the present study gives a fairly good description of pausology in dyadic conversation.

Goldman-Eisler (1968:12-14) claims that in spontaneous speech, such as casual conversation, pauses do not correspond to syntactic structures. In fact, pauses are often placed so that they make the understanding of the message more difficult. Goldman-Eisler, however, promotes the idea that pauses can reveal something of the process of formulating ideas to words and sentences. Although outside the scope of this study, this is an interesting application of pausological research.

2.2.3. Turn

As the conversation goes on the speakers continue to take turns in speaking. They do not normally both speak at the same time. In fact, simultaneous speech is usually a good sign that something has gone wrong. (Scollon and Scollon 1981:24)

The American College Dictionary defines turn as "the time for action or proceeding which comes in due rotation or order for each of a number of persons." It would be a gross simplification to adopt this definition for a phenomenon as complex and controversial as a turn of speaking. The following discussion attempts to form an adequate theoretical basis, so that an operational definition for the phenomenon can be formulated. To begin with, it should be noted that in the present study the terms 'turn of speaking', 'speaking turn', 'turn' and 'floor' are used interchangeably.

The alternation of turns forms discourse where the roles of listener and talker toggle. As Jaffe and Feldstein (1970:3) point out, it is the key feature of dialogic rhythm that speakers speak in turns. This linguistic universal has a neurophysiological basis: it is difficult, if not impossible, to speak and listen simultaneously, without one task interfering with the other (see Goldman-Eisler 1980). This is reflected in conversation in the low frequency and short mean duration of simultaneous speech: only one person holds the floor at a time.

It is possible to define turn on the basis of semantic, kinetic or temporal criteria, or combinations thereof (Feldstein et al. 1979:75). Since one of the aims of the present study is to develop an automatic conversation timing system, all semantics must be excluded. Furthermore, since telephone conversations will be measured no visual clues will be present. This leaves us with temporal criteria as the only applicable basis for selection. There are several reported studies that have measured temporally defined turns in conversation (see eg. Jaffe & Feldstein 1970; Crown 1982; Beattie 1979a, 1983; Welkowitz & Bond & Feldstein 1984).

In her study of turn switching Tiittula (1985b:4) has given two definitions of turn, the first is theoretical and the second operational. According to the first definition, a turn is a sequence of speech produced by one speaker and bounded by the turns of other speakers. It is clear that this definition is not satisfactory because the definition contains the defined term. The second definition describes turn so that it begins when a speaker starts to speak and ends when he stops and another speaker starts. This definition is a close approximation of Jaffe's and Feldstein's (1970:19) operational definition. Tiittula regards one word as the minimum length of a turn. She does not accept back-channel utterances, such as yeah, right, ok, joo and hmm as turns.

Oreström (1983:23) emphasizes that speaking-turns and back-channel items be kept apart. This view is supported by Beattie (1983), among others. In the present study, back-channel utterances are considered valid turns for two major reasons. First, this work applies an automatic measurement of speech chronology. It would be next to impossible to 'teach' a machine to decide semantically whether an utterance is back-channel or not. Indeed, as Tiittula points out, it is difficult for a researcher to make the distinction (1985b; 5-6). Second, this study concentrates on a subcategory of dyadic speech, namely telephone conversation, where, due to the lack of visual contact between speakers, back-channel utterances play an especially important role in assuring flawless information flow (Beattie 1983:99). Furthermore, bearing in mind the contrastive nature of this study and the fact that communication in second (learned) language is involved, back-channel utterances can be claimed to form an essential part of the

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discourse. In fact, although their presence is not specifically emphasized, their frequency of occurrence, which affects the number and length of turns and simultaneous speech, may well provide valuable information about the flow of conversation.

Jaffe's and Feldstein's view of turn is adopted as such:

(Def 3) **A speaking turn begins the instant one of the speakers in an interaction begins talking alone and ends immediately prior to the instant the other speaker starts talking alone. Thus, a turn is the interval between two successive speaker switches. (Jaffe and Feldstein 1970:19)**

The internal structure of a turn is not investigated in this study. It is noted, however, that the beginning and end of a turn are critical periods. Clark and Clark (1977:248) suggest that, the global planning of an utterance takes place at the beginning of an utterance, whereas, local (word by word) planning is done along the turn. Therefore, hesitation and restarts should occur turn-initially. As Beattie (1979b:68) Stenström (forthcoming) show, there are several counter-examples. Beattie has found that -- inasmuch as hesitations can be said to reflect planning of speech units -- planning tends to occur at later stages as well as at the beginning of a cluster of words: only 32% of the pauses were found to be in a clause-initial position (Beattie 1979b:68). Stenström emphasizes that especially in view of turn-holding pausology shows evidence of later stage planning: a person wishing to hold the turn uses complex strings of hesitation to gain time and prevent others from taking the turn.

The end of a turn is critical since it shows how the turn is yielded. Stenström points out that silent pauses are the most typical turn-yielders. They are of special interest in the present study.

2.2.4. Switching Pause

Theoretically, switching pause can be described as the time lapse between successive turns (Beattie 1983:29). This definition does not match with the definition adopted for turn (see Def. 3) since turn is regarded to include a possible switching pause. The way switching pause is defined as well as the label it is given varies according to the emphasis of the study. If the processing time before an answer is measured, the terms 'response latency' or 'reaction time latency' are used (see e.g. Wiens et al. 1976). If switching pauses are seen as a subcategory of pauses in general, they are called transition pauses (see e.g. Butterworth et al. 1977). Jaffe and Feldstein (1970: 10) have shown that -- at least according to their measuring methods -- only about 25% of all speaker switches are done with no perceptible pause. The remaining 75% are divided between switches where

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turn is taken without pause and switches where simultaneous speaking is involved. Stenström (forthcoming) and Tiittula (1985b) both agree that silent pauses are the most typical turn-yielders.

Stenström (forthcoming) brings up, but leaves open, the question of whether switching pauses should be credited to the speaker who yields the turn or to the speaker who gains it. Considering the matter from a practical point of view, there are three possible approaches. First, a switching pause is in some sense "no-man's land": time belonging to no-one in particular. This approach, however, is not very fruitful as it would make the definition of turn more complicated and would, in a way, result in the loss of valuable information. Furthermore, it can be claimed that there are two people for whom the switching pause has special meaning: the speaker who yields the turn and the speaker who takes the turn. In what follows the former will be referred to as the yielder and the latter as the taker.

A second possible approach is to credit the switching pause to the yielder. After all, by the definition adopted here (see Def. 3 in chapter 2.2.3.), it is still his turn. Furthermore, he is the one who initiates the pause. As a third approach, the turn taker could be credited with the switching pause as he is the one who has made the decision that the time was right to take the turn. According to this view, switching pause can be defined as the waiting-time of the next speaker. Thus, as mentioned earlier, instead of calling it switching pause, many researchers call it 'response latency' or 'reaction time' (see e.g. Siegman and Reynolds 1982). It is not significant whether switching pauses are credited to the yielder or to the taker, as long as the crediting is done consistently. This is because switching pause times can later be extracted and treated in either way according to where the emphasis of the study lies. It should be noted, however, that switching pause times are reflected in other parameters as well. In this study, switching pauses are always credited to the turn yielder, mainly because Jaffe and Feldstein (1970), Feldstein and Welkowitz (1978) and Lustig (1980) have done so in their studies.

Jaffe and Feldstein (1970:19) have presented the following definition for switching pause:

> A switching pause is an interval of joint silence initiated by the speaker who has the turn, or floor, and terminated by the other speaker, who thereby obtains the floor. Thus, it marks a change of speakers and, inasmuch as it occurs within the turn of the speaker by whom it is initiated, it is credited to him/her.

To give a precise definition that takes into account the characteristics and limitations of the present system, the definition given above is modified slightly:

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(Def 4) A switching pause is an interval of joint silence exceeding 250 milliseconds in length, initiated by another speaker. Thus, it marks a change of speakers and, inasmuch as it occurs within the turn of the speaker by whom it is initiated, it is credited to him/her.

2.2.5. Simultaneous Speaking

As can be seen in Figure 1, speakers tend to speak in turns but occasionally fail to do so, which results in both speakers speaking at the same time. Norwine and Murphy (1938) call this phenomenon 'double talking.' Jaffe and Feldstein (1970) call it 'simultaneous speaking' or 'simultaneous speech', which are terms used widely in psychological studies.

Simultaneous speech -- more than one person speaking at the same time -- is generally seen as a symptom of difficulties in turn taking or turn yielding. Therefore, it is reasonable to conclude that this variable provides information on the fluency of the flow of conversation, and is therefore of special importance for this study. This means that simultaneous speech is seen as a malfunction of normal turn switching. This view is supported by several studies (see, for instance, Jaffe and Feldstein 1970, Tiittula 1985a, 1985b and Stenström (forthcoming)). On the other hand, Tannen (1984:83) has claimed that simultaneous speech can also be seen as an index to the level of involvement. She sees simultaneous speech as one indication of high involvement.

According to Jaffe and Feldstein (1970), Norwine and Murphy (1938:282) consider that double talking occurs when a person is speaking and at the same time hears speech from the other person. This definition is too vague for the purposes of this study: we cannot base the measurement of simultaneous speech on whether the speakers hear each other or not. Furthermore, it is not clear what Norwine and Murphy mean by hearing. For the sake of clarity and explicitness it is justifiable to assume that the speakers hear each other when they converse; if they do not, they express it somehow. An operational definition provided by Jaffe and Feldstein (1970:19) for simultaneous speech is adopted here as such:

(Def 5a) Simultaneous speech is speech uttered by a speaker who does not have the floor during a vocalization by the speaker who has the floor.

The adopted definition means that simultaneous speech is credited to the person who does not have the turn. This is contrary to Lustig's (1980:4) view of simultaneous speech, according to which it is credited to the person who has the turn. This is a rather confusing way of treating simultaneous speech time. Lustig justifies the decision by claiming that the "measure refers to the 'target' of the multiple speech act, and might profitably be thought of as being spoken to" (Lustig 1980:10).

Jaffe and Feldstein (1970) differentiate between two kinds of simultaneous speech on the basis of whether it results in speaker switch or not. Simultaneous speaking which does not result in turn switching is considered non-interrupting, whereas, if a speaker switch occurs in connection with the simultaneous speech, it is considered interruptive:

(Def 5b) **Interruptive simultaneous speech is a speech segment that begins while the speaker who has the floor is talking and ends after he has stopped. Only that portion uttered while the other speaker is talking is considered simultaneous speech. (Jaffe and Feldstein 1970:19)**

(Def 5c) **Noninterruptive simultaneous speech begins and ends while the speaker who has the floor is talking. (Jaffe and Feldstein 1970:19)**

This view is different from the one promoted by Vrugt and Kerkstra (1984:26), according to which an interruption occurs whenever someone who does not have the turn begins speaking while the person who has the turn is speaking. Apparently, Vrugt and Kerkstra consider all simultaneous speech as interruption regardless of whether there is a turn shift. This shows that even though certain terminology is used and widely accepted, the definitions of the terms are misleadingly different.

2.2.6. Justification of the Parameter Selection

The conversation chronography parameters described in the previous sections are, of course, not the only measurable variables of dyadic conversation. They were chosen as key parameters in the present study for a number of reasons. First, explicit operational definitions could be provided for them. Automatic measurement by definition rules out any human intervention; so the machine must be capable of deducing the duration of any phenomenon to be measured. For this reason, parameters such as rate of articulation -- if defined in terms of syllables or words -- could not be used, since, for the time being, it is impossible to define the terms 'syllable' or 'word' clearly enough for a machine to measure them reliably.

Second, the parameters chosen have been measured and reported in the literature. Studies performed by researchers such as Goldman-Eisler, Jaffe, Feldstein, Welkowitz, Lehtonen, Grosjean, Beattie, Siegman and Brown have all used some or all of the selected parameters in their studies, which therefore form a natural basis for a discussion of the results. Third, the selected parameters have been defined so that they form a fairly comprehensive network: vocalization and pause figures are elements describing vocal activity and fluency; number and average length of turns provide information on interaction and dominance; switching pause figures tell us about turn yielding and turn taking habits; simultaneous speech figures present an indication of the fluency of conversation flow and possible problems in turn switching. This is illustrated in Figure 3.

The parameters can be divided into two different groups on the basis of whether they are directly measurable as such or whether they need to be calculated using other parameters. Simple variables -- vocalization and silence -- are the basic structural elements of speech: there either is or is not sound. According to the definitions adopted here, all other parameters are complex: they are defined using the simple parameters. Silence as such is not very useful in the present study. Its subcategories, pauses, switching pauses, and 'listening silence' -- the time each speaker spends without vocalizing while listening to another speaker -- are more useful as they reflect conversation chronography in more detail.

```
VOC 1-- - --   --- -- - -----
    2        ----       - - --- -
P   1  - -        -  - -
    2                          -
T   1---------    ------------
    2        ----            ----
SWP 1      --
    2
SIM 1          --
    2                   - - -
INT 1          --
    2                       -
NON 1
    2                   - -
    -------------------------------->
                                Time
```

Figure 3. Application of the parameters. VOC stands for vocalization, P for pause, T for Turn, SWP for switching pause, SIM for simultaneous speaking (total), INT for interruptive simultaneous speaking and NON for non-interruptive simultaneous speaking. Numbers 1 and 2 refer to speakers.

There are two peculiarities in the resulting application. Since our definition of pause requires that the speaker has the turn, silences within

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simultaneous speech are not regarded as pause. Instead, each vocalization in simultaneous speech -- as r gards the person who is talking during the other speaker's turn -- is counted as a new occurrence of simultaneous speech. This is not a major problem since spurts of simultaneous speaking tend to be very short. The other peculiarity is that when two speakers start to talk at the same time, the one who most recently had the turn, is not credited with speaking simultaneously; rather the one who did not have the turn is credited with simultaneous speaking. This is natural in terms of the definitions adopted here for turn and simultaneous speaking.

The parameters selected are relatively easy to measure reliably when defined a in the present study. Data is available from other experiments and studies using these parameters, which facilitates comparisons. Figures such as word or syllable count, in addition to being difficult to implement using a computer, do not produce directly applicable data when different languages with varying word and syllable lengths are involved, as is the case in the present study.

2.3. Special Features of Telephone Conversation

Telephone conversation differs from a face-to-face situation in several ways. It cannot be claimed to be a natural form of communication, since so much redundancy is lost with the lack of visual contact. This study concentrated on telephone conversation for two major reasons. First, the lack of visual clues simplifies the task of analyzing the parameters involved by reducing the number of intervening factors, such as facial expressions and gaze. Second, the easiest way to solve the problem of microphone cross-talk without using throat microphones is to put the speakers in separate rooms.

It has been shown (see eg. Argyle 1972) that visual clues play an important role in turn switching. It would be logical, theretore, to assume that when the speakers are denied all visual clues of turn yielding/taking as is the case in telephone conversation, the turn switching mechanism would be at least partially impaired. However, an experimental test by Cook and Lalljee (1972) did not confirm this hypothesis. Moreover, Beattie (1981, 1983) has discovered that "turn-taking on the telephone appears to be remarkably smooth, quick and efficient. Speakers exchange the floor with minimum delay and with little simultaneous speech" (1983:155) and that speaker-switching is apparently executed faster on the telephone than in face-to-face interaction (1983:96). Verbal cues must be considered adequate to enable a chronologically smooth flow of conversation.

Beattie (1983:96) shows that the duration of simultaneous speech is longer in telephone conversation but remarks that the difference is not statistically significant. Furthermore, Beattie (1983:99) claims that filled pauses assume greater importance in the management of telephone conversation. Beattie (1979:224) concludes that there is no evidence that the absence of visual clues affects turn-switching.

Butterworth, Hine and Brady (1977) conducted an experiment in which the chronographies of conversations in three different communication situations were compared. In one situation the subjects could see each other, in the other two they could not. The latter two conditions differed in that in the first one the subjects sat on opposite sides of a table with a screen between them to prevent visual clues. In the last condition the subjects were seated in separate rooms and talked to each other over a telephone line. It was found that conversation chronography was different in all three conditions. For instance, the within-speaker percentage of pauses was 20% over the telephone line, 27% when visual clues were allowed and 31.5% in the screen condition. This suggests that telephone conversation differs from face-to-face as well as from non-vision conversation. The verbal substitutes employed on the telephone -- exaggerated intonational patterns, briefness of grammatical pauses, greater number of back-channel items -- were not present when the subjects were separated by a screen (Butterworth et al. 1977).

Telephone calls are usually made for a particular reason: there is a problem that needs to be solved. Time is considered valuable; telephone directories and business communication textbooks urge us to use the phone briefly and efficiently. This learned need for efficiency may well affect the way we behave in telephonic conversation. However, as Beattie (1979, 1983) has shown, the chronographical differences between face-to-face and telephone conversations are small, and where they exist, they are consistent and therefore predictable. This means that to some extent the results of measurements carried out on telephone conversations can be assumed to apply to face-to-face situations as well.

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3. THE SCOPE OF THE STUDY

The theoretical discussion in the previous chapter yielded a number of parameters of conversation chronography. They were also defined in such a way that an automatic analysis of these parameters is possible. This is essential in order to provide an accurate outline of the present study.

The aim of this study is to measure possible differences in conversation chronography in terms of vocalizations, pauses, turns, switching pauses, and simultaneous speech in intracultural and intercultural telephone conversations of Finns and Americans. Instead of going through the task of transcribing the telephone conversations, an Automatic Conversation Timing System (ACTS) will be used. The development and testing of the system forms an integral part of this study. The results of the present study will be compared to the those of some earlier studies, and, where possible, conclusions will be made about the communicative behaviour of both culture groups, with special emphasis on establishing chronological differences which hinder intercultural communication.

Since this study employs a computerized measuring system, there is no way in which any discourse analysis in the traditional sense could be carried out. This also means that evaluation of communicative competence falls outside the scope of this study.

Thus, an answer is sought to the following questions:

- Are there observable differences in conversation chronology between "Silent Finns" and "Loquacious Americans"?

- If there are cultural differences, how do they show in dyadic communication?

- To what extent do possible cultural differences diminish or increase in intercultural communication due to mutual influence?

- Is it possible to draw conclusions on the basis of mere chronological data of conversations?

- Are there any specific differences that hinder intercultural communication?

The discussion based on the results of the measurements is highly speculative due to two facts: first, experiments of this type are rather rare, and second, the number of subjects is limited.

4. EXPERIMENTAL PROCEDURE

One of the objectives of the present study is to measure and compare a set of conversation chronography parameters in Finn-Finn, Finn-American and American-American telephone conversations. The basic idea behind the test is to record the voices of the speakers engaged in telephone discussions on separate channels and, later, process the recordings using a computer. The telephone conversations were oriented towards problem solving.

To accomplish the task of recording the conversations a number of informants were invited to the studio in pairs to solve problems over a telephone line. This chapter describes the test arrangements.

4.1. The Subjects

The number of informants was limited to four Americans and four Finns mainly because of the small number of Americans available. Each nationality was represented by two males and two females. The Finns were chosen on the basis of two major criteria: their command of spoken English and their age. Furthermore, to make the groups as homogeneous as possible, the selection was limited to people with academic interests. Therefore, it was natural to select advanced students of English and staff members of the University of Jyväskylä.

Group 1 consisted of four Finns, two males and two females. The ages of the Finns were 25, 25, 29 and 29 years (mean=27). The males were advanced students majoring in English and the females were junior staff members at the university. Two of the Finns were born in Central Finland, one on the west coast and one in Eastern Finland. All Finns had spent at least five years in Jyväskylä, mainly as students. In the discussions to follow, Group 1 will be referred to as 'Finns'.

Group 2 included four native speakers of English, two males and two females. All subjects in group 2 were or had been teachers at the university. Three of them were Americans from Colorado, Montana and New York. The fourth member of group 2 was born in the United States but had spent most of her life in Canada. The ages of the members of group two were 24, 25, 28 and 40 years (mean=29.25). Two members of this group had spent less than 6 months in Finland, whereas two had lived in Finland for 3 and 4 years. Group 2 will be referred to as 'Americans.'

In both groups most subjects knew each other. There was one American who had not met one of the Finns and any of the Americans before.

4.2. The Conversations and Tasks

Each subject engaged in a telephone conversation with each of his countrymen in his/her native language and with two members of the other group in English. This arrangement produced 6 Finn-Finn, 6 American -American and 8 Finn-American conversations. Thus, each subject took part in 5 conversations limited to approximately 12 minutes. Figure 4 shows a chart of the conversations.

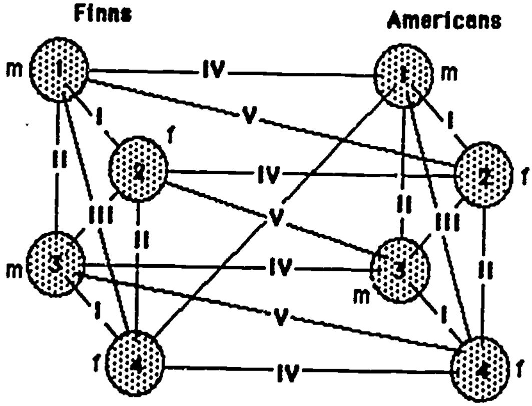

Figure 4. Conversation chart. The subjects are shown as numbered circles. m=male; f=female. Lines connecting the circles represent telephone conversations. Roman numbers beside the lines are task numbers.

The conversations had an objective: solving a given problem. The tasks consisted of cartoon strips that were cut into separate frames so that each person had some labelled fragments of each strip in random order. The tasks involved deducing the number of different strips present and the correct order of the frames in each strip. Since the sheets of cartoons which the subjects had were complementary, completing the task meant that the subjects needed to describe the frames they had and discuss where each frame would fit. This assured that each pair of subjects would have something to talk about. Furthermore, the topic of the conversations was the same in all discussions.

Since each person took part in five conversations, five different tasks were required. The tasks were all similar in that they consisted of cartoons of the same type, drawn in most cases by the same artists. The cartoons were chosen so that they had a clear plot and that there were clues to help restore the correct order of the frames. The tasks were intended to be of approximately equal difficulty. The 5 pairs of task sheets are shown in Appendix A.

The conversations were recorded in a studio during the autumn of 1985 and the spring of 1986. Before the conversations the subjects were given time to read the instructions. The subjects marked their solutions on answer forms by writing the labeling letters of the frames in correct order into predrawn slots. The instruction sheet and a blank answer form are shown in Appendices B and C, respectively.

The subjects knew that the conversation would be recorded but to maintain some level of naturalness and to avoid biasing in the resulting data, the subjects were not told what aspects of the recording would be measured. Instead, they were led to believe that it was important to solve the problem which they were faced with. They were informed that the time would be limited to about 12 minutes.

4.3. Recording Arrangements

A small studio with two connecting rooms was used. The subjects met before they were lead into separate rooms. Each subject sat at a table onto which the cartoon sheet (size A3) was attached. The instruction sheet and

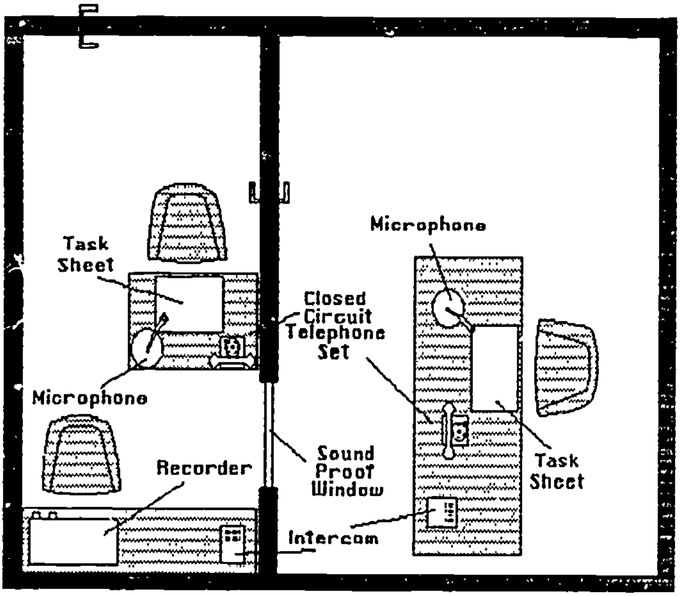

Figure 5. The setup for the recording.

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the answer form were placed on top of the cartoon sheet to cover it so that the subjects could not see the cartoon frames before the beginning of the test. If either one of the subjects had not done the test before, the subject was given five minutes were given to read the instructions. The subjects were asked if they had any questions about the instructions. If they had, both parties heard the answers or further instructions given by the experimenter.

The experimenter and the recording equipment were placed in the same room with one of the subjects. The subjects could not see each other and they could hear each other only via the telephone. The experimenter could see and hear both subjects all the time. Visual contact was possible via a sound proof window between the two room. The subject in the other room heard the experimenter's voice through a studio intercom. The experimenter wore headphones through which he heard what the subjects said. A diagram of the setup is shown in Figure 5.

The conversations were Recorded on Sony HF C-60 cassettes using two studio quality microphones (AKG CE-1) and an AKAI CS-F21 stereo cassette recorder. The speaker channels were kept separate, one on the left channel and the other on the right. This assured easy separation of speaker voices at the processing stage. No filtering or compressing of any kind was used apart from Dolby B noise reduction. The same recorder was used for the later processing of the data.

4.4. The Data

The twenty recordings, each lasting between 12 and 15 minutes and having similar topics, produced over 250 minutes of telephonic conversation of the four Finns and four Americans. The recordings were stored on C-cassettes. The answer sheets contained a number of questions about the speaker's background, such as age, number of years in Finland, etc. The answers to the given problem, ie. the correct order of the cartoon frames, were not regarded as data.

5. THE PROCESSING OF THE DATA

As one of the aims of this study was to create a reliable, yet inexpensive automatic analysis system of conversation chronography parameters, a computer solution was adopted. In **Rhythms of Dialogue** (1970) Jaffe and Feldstein describe their Automatic Vocal Transaction Analyzer. As has been explained in Chapter 2 above, many of Jaffe's and Feldstein's operational definitions of conversation chronography parameters were adopted as such while some were modified rather radically to serve the interests of the present study. Their AVTA has undeniably served as the basis for the system described in this chapter.

5.1. Jaffe's and Feldstein's AVTA

A key feature of Jaffe's and Feldstein's vocal transaction analyzing system was that it separated the speaker's voices through analog cancelling, thus solving the cross-talk problem which arises when the speakers are close to each other and ordinary microphones are used. The system supported two speech channels. The signals from the two sources (microphones or recorders) were compared and identical parts were cancelled. In the AVTA, the presence or absence of speech signal on each channel was detected by a speech detector, which thus produced the binary on/off input data for the on-line computer (Jaffe and Feldstein 1970:123-130). Figure 6 shows a block diagram of the AVTA.

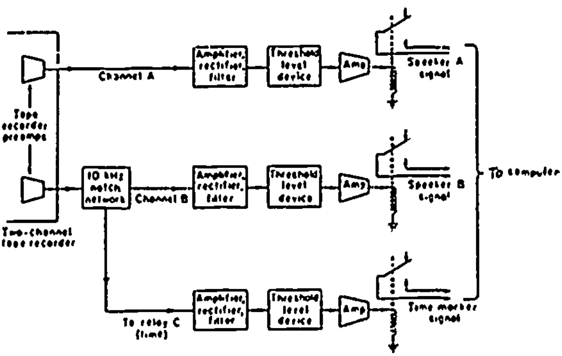

Figure 6. A block diagram of the AVTA system. (Jaffe and Feldstein 1970:124).

The data -- now in the digital form of a long series of ones and zeroes for each channel -- was then further processed to extract the conversation chronography parameters. Jaffe's and Feldstein's system regarded dyadic conversation as a four-state matrix, since there were four possible combinations, as shown in Table 2. The operational definition for the parameters -- as described in Chapter 1 -- were applied in the form of a computer program which operated on the four-state data. This form of representing the data is both logical and natural, because, being based on the binary system, it is in the form in which all data is stored in a computer.

Table 2. A four state matrix. In the AVTA, each sample could have four different states, depending on whether either of the speakers of the dyad was vocalizing at the time the sample was taken.

	Speaker 1	Speaker 2
Case 1	Silence	Silence
Case 2	Silence	Vocalization
Case 3	Vocalization	Silence
Case 4	Vocalization	Vocalization

The number of bits (=binary digits) is equivalent to the number of channels that can be measured. In the present system, four bits -- facilitating four separate channels -- are used.

5.2. Problems and Solutions in Speech Detection

Jaffe and Feldstein (1970) point out that the presence or absence of speech is a complex function affected by many independent features of the system. Among these features they mention:

1) The intensity of the vocal signal
2) The background noise during the conversation
3) The threshold setting for voice relay closure
4) Smoothing of the analog waveform
5) The sampling rate
6) The cross-over cancel function

In the system created for the present study, the Automatic Conversation Timing System (ACTS), these problems are solved in much the same way as in its predecessor, Jaffe & Feldstein's Automatic Vocal Transaction Analyzer (AVTA). Figure 7 presents a block diagram of the ACTS. The system is by no means definitive in the sense that it could not be improved. The solutions to the problems listed above are presented here only to the degree they are relevant to the present application, which is telephone conversation.

Item one, the intensity of the vocal signal, is closely connected with item three, the threshold setting. In the AVTA these problems were solved by means of lights indicating the state of the gate and adjustable amplification and threshold levels. The system was calibrated by the examiner. In the ACTS, this method was simplified by making only the amplification level adjustable. The threshold level of the gate is of the order of 40 dB. As a result of this, random tape noise did not trigger the gate. It should be noted, however, that the calibration levels chosen were arbitrary; slight variations in the amplification level do not change the results significantly, but obvious misadjusting results in erratic figures. The differences are caused mainly by intensity drops at the end of phrases. (For further discussion of the reliability of the ACTS, see Chapter 7.3.)

Item two, the conversation background noise, is not relevant to the present study, since the recordings were done in studio conditions. If the background noise consists of narrow frequency bands, audio frequency filters can be used to evade the problem. As such, the ACTS provides no means of eliminating random noise.

The gating device uses a time constant of approximately 40 ms in smoothing the speech signal. For this reason, the pauses between single flaps of the vocal chords are not noted. The time constant delays both the beginning and the end of the on/off output data, so that it does not bias the results by either lengthening or shortening the vocalizations.

The AVTA used a sampling frequency which could be varied between 1 and 10 samples per second. For the studies presented in Rhythms of Dialogue (1970), Jaffe and Feldstein chose a sampling rate of 200 samples per minute, or 3.33 samples per second. The ACTS uses a fixed sampling rate of 4 samples per second. Thus, it is easy to keep track of time because each sample represents 250 milliseconds. Whether each sample shows vocalization or silence is determined by the on/off ratio of each period of 250 milliseconds of conversation time. Within each 250-millisecond sample period, the status of the gate is checked more than 100 times, which well exceeds the accuracy of the gate. This means that the ACTS uses two levels of sampling, one level to assure adequate accuracy and another level to optimize memory usage.

Item 6, the problem of cross-talk, ie. the voice of one speaker reaching the other speaker's microphone, did not exist in the present study. This was due to the fact that the subjects were seated in separate rooms. The only cross-talk possible was thus due to the magnetic media and the magnetic heads of the recorder. For other applications of the ACTS, in which the

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speakers are seated in the same room (eg. panel discussion), either some type of intelligent cross-talk cancelling apparata could be applied, or throat microphones could be used for multi-channel recording.

5.3. Hardware Features of the ACTS

The ACTS consists of a multichannel calibration amplifier, a speech detector -- here referred to as the gate -- and a standard Commodore 64 microcomputer with a monitor, one disk drive and a dot matrix printer for graphics and alphanumeric output. The analog signal from the calibration amplifier is fed to the gate where it is converted into a simplified digital form which only indicates whether there is vocalization or silence in each channel. Finally, this digital data is sampled and recorded by the computer. Figure 7 shows the block diagram of the ACTS.

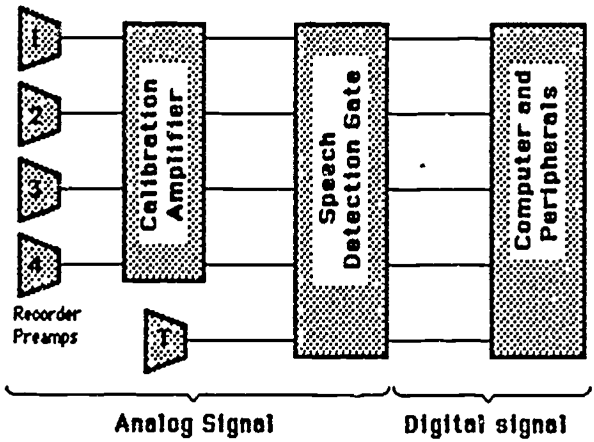

Figure 7. A block diagram of the ACTS.

The six-channel gate which is used for the present study was built earlier for other purposes -- hence the six channels. Measurements with an ink jet plotter (four-channel Oscillomink L) showed that the gate was suitable as such for speech recognition. The gate worked well on the data recorded for this study. Occasional errors in speech detection are, of course, inevitable. Most errors seemed to be caused by long voiceless fricatives at the ends of phrases where the intensity is naturally lower. These errors are assumed to be insignificant.

The gate was connected to the computer via one of the computer's built-in control ports. Thus, no custom built hardware, apart from the gate and the connecting cables, is needed. Five of the six channels of the gate were connected: four for speech detection data and the fifth for the possible remote start/stop triggering of the system. As a result of the reasonable sampling frequency chosen (4 Hz), no additional time channel or time marks of any sort are needed. The computer can easily calculate the time lapsed from the beginning of the measurement in minutes, seconds and quarters of a second.

5.4. Software Features of the ACTS

The computer was programmed to read the control port more than a hundred times per second and to calculate whether there were more ones or zero's for each of the four channels. Each channel was kept separate from the others at all times. Table 3 shows the representation of he data in the computer's memory.

The computer programs were written to handle as many as four channels simultaneously. However, as this study deals with telephonic conversation, only two of the channels were used for speech data. The remaining two channels were used for storing the data of speaking turns as computed by the computer. This proved to be very illustrative and it offered an easy way to control the working of the computer. Figure 8 presents a sample of the graphics output showing the vocalizations and turns of one telephone conversation.

Table 3. The internal representation of the data in the ACTS.

Start of First Half of Vocalization Table

Start of Second Half of Vocalization Table

	Speaker 4	3	2	1	4	3	2	1
Byte 1	1	0	0	0	0	0	0	1
Byte 2	0	0	0	0	0	0	0	1
Byte 3	0	0	0	0	0	0	0	0
•	0	0	0	0	0	0	0	0
•	0	0	1	1	0	0	1	0
•	0	1	1	0	0	0	1	0
	0	1	0	0	0	0	0	0
	[illegible]	[illegible]	0	0	0	0	1	0
:								
Byte n-1	0	1	1	0	0	0	1	0
Byte n	0	1	0	0	0	0	0	0

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The measuring routine was written in Assembly Language to assure correct timing and total control of the flow of events. The main program with its mathematical routines and graphics features was written in Simons' BASIC, an expanded dialect of the standard Microsoft BASIC 2.0. Due to the fact 53 that the chosen version of BASIC was an interpreter and not a compiler, the calculations proved to be rather slow. Because of the limited memory size (64 kilobytes) of the computer, rather clumsy and complicated programming arrangements were needed to enable the handling of the large quantities of data produced by this kind of experiment. However, the task was not a futile one, since the result is in accordance with the set objective: an inexpensive system for the analysis of conversation chronography in dyadic, triadic or tetradic conversation.

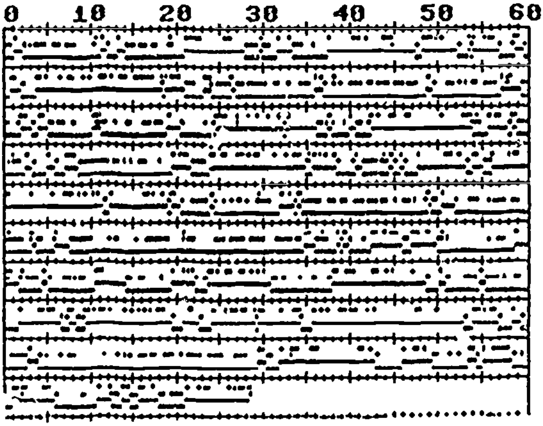

Figure 8. Graphics representation of the first 9 minutes and 30 seconds of one telephone conversation as shown by the ACTS. Each minute is shown in a rectangle. The upper bar shows the vocalizations of speaker 1, the second bar shows the vocalization of speaker 2, and the two bottom bars show the turns of the speaker 1 and 2 respectively.

On the basis of earlier studies (Jaffe and Feldstein 1970; Feldstein and Welkowitz 1978; Beattie 1979; Lustig 1980), it was decided that for each parameter, depending on its nature, either the absolute number or total time of occurrences would be calculated. Furthermore, the percentual amount of total conversation time would be calculated where necessary. Furthermore, averages and standard deviations would be computed for each parameter.

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5.5. The Measurements and the Analysis of the Data

The cassette tapes were played back using the same AKAI CS-F21 deck which was used for the recordings. The signals of each channel were lead from the recorder's LINE OUT connectors through an auxiliary amplifier to the gate and, finally, to the computer. Four times a second the computer marked each channel as either 1 (vocalization) or 0 (silence). This information for the whole measured time was stored in the computer's memory (see Figure 7). Because the calculations proved to be rather time-consuming, the length of the measurement for each conversation was limited to approximately 9 minutes and 30 seconds. This time limit was flexible: the measuring was terminated at a turn switch, so that the data would not be distorted.

When the conversation was in the computer's memory, the data was stored on disk for possible further analysis. Then the calculations described in section 5.4 were performed. After the calculations were complete, the results were shown on the screen, stored on disk and printed on a printer. Table 4 shows an sample output of the calculations.

Table 4. Statistical output produced by the ACTS.

Total time				009:29.000
Time slice				009:28.250
Time range				000:00.000-009:28.250
	Ch1	Ch2	Ch3	Ch4
Voc %	22.35	28.66		
Voc x	577	777		
Voc s	337	543		
Turn #	84	84		
Turn x	3205	3560		
Turn s	3762	4663		
SwP #	65	58		
SwP x	688	780		
SwP s	622	489		
Pause %	46.44	36.95		
Pause x	841	775		
Pause s	816	625		
Sim #	25	12		
Sim %	1.19	0.70		
Int #	12	6		
Int %	0.53	0.35		

Vocal %	49.32	Silence %	50.68
S Pause %	15.84	Sim. sp %	1.89

The results of the calculations were then fed to a mainframe computer for further statistical analysis using the Expanded Statistical Package for Social Sciences (SPSS-X). Minimums and maximums were found, arithmetic

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means and standard deviations were calculated. Significance testing was carried out using non-parametric tests: the Mann-Whittney U-Test for differences between the Finn-Finn and Am-Am conversations, and the Wilcoxon Matched Pairs Signed Ranks Test for differences between Finns and Americans within the intercultural conversations. The reliability of the system (see Chapter 7.3.) was tested using a Split Model Reliability Test.

6. THE RESULTS

The processing described in Chapter 5 produced statistical results for all variables. In this chapter, the resulting statistical figures for each variable are presented as the variables are discussed. Chapter 7 provides more discussion on the interaction between the variables as well as some suggested interpretations of the results. The conversation specific results produced by the ACTS are presented in Appendix D.

In the text, for the sake of brevity, the group of Finn-Finn conversations is referred to as 'Finn-Finn', and the group of American-American conversations is referred to as 'Am-Am.' Likewise, the role of Finns in Finn-American conversations is termed 'Finn-Am' and the part of Americans 'Am-Finn.' For the sake of clarity, in the tables and graphic representations 'Finns' refers to Finn-Finn conversations and 'Americans' to American -American conversations. In all tables and figures, 'Overall Average' is the unweighted mean of the various groups averages. All numbers of occurrence are measured of the first 9 minutes and 30 seconds of the telephone conversations.

6.1. Vocalization

The vocalization percentages of the Finn-Finn and Am-Am groups differed greatly. For Finns, the percentage was 29.2; for Americans, it was 36.5. According to the Mann-Whittney U-Test, the difference is significant ($U=1.5$, z-score=-2.56, $p<.01$). Table 5 presents the vocalization percentages, mean lengths of vocalization and standard deviations of mean lengths of vocalization in the telephone conversations.

As can be seen in Table 5, the mean vocalization length varies from 755.62 milliseconds (Finn-Am) to 998 milliseconds (Am-Am). Thus, the difference between these two extremes is 243 ms, which means that the mean vocalization is one fifth shorter when Finns talk to Americans as compared to Americans talking to one another. The standard deviation of the average vocalization length ranges from 102 (Finn-Am) to 149 (Am-Finn). In groups Finn-Finn and Finn-Am the vocalization percentage is lower than in the other groups, ie. Finns have a lower vocalization percentage than Americans. The vocalization percentage is the lowest when a Finn talks to a Finn (in Finnish). On the other hand, the vocalization percentage is the highest when an American talks to another American. The average vocalization length is the shortest when a Finn talks to an American and the longest when an American talks to an American. Further, the standard deviation of the average vocalization length is the lowest when a Finn talks to an American, and the highest when an American talks to a Finn. This implies that the groups of Finns are more homogeneous as regards the mean length of vocalization.

Table 5. Vocalization in telephone conversation.

Vocalization		Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.
Vocalization % of Total Time		29.2	31.2	34.2	36.5	32.8
Average vocali-zation length (ms)	Mean	895	755	836	998	906
	Std. Dev.	114	102	149	134	125
Mean Std. Dev. of Voc. Length		755	516	754	823	712

The standard deviation of the average vocalization length reflects the homogeneity of the vocalization length within a group. When Americans talk to one another, their vocalizations are more variable in length (stddev=823 ms) than when Finns talk to Americans (stddev=516 ms). The difference is greater than would be expected from a comparison of the differences in the mean length of vocalization.

6.2. Pause

The pause percentages of the Finn-Finn conversations differ significantly from those of the Am-Am conversations (U=2.0, z-score=.0, $p<.01$; Mann-Whittney U-Test). For Finns, the pause percentage is 36.8 and for Americans 21.8. The difference in the pause percentages of the total time between Finns and Americans in intercultural conversations is not significant (z-score=0.9802, n=8, n.s.; Wilcoxon). Table 6 shows the pause percentages of the total turn time, means of average pause lengths, and standard deviations of the average pause length.

The mean length of pause ranges from 851 milliseconds (Finn-Finn) to 504 milliseconds (Am-Am). The 347 millisecond difference between these two values is almost significant (U=3.0, z-score=-2.40, $p<.05$; Mann-Whittney). In other words, Finns talking to one another have a pause percentage 1.7 times higher than Americans talking to each other. Likewise, the average length of a pause is 1.7 times as long for Finns as it is for Americans. The

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standard deviation of the average pause length is 5.5 times higher for the Finn-Finn conversations than it is for the Am-Am conversations. This means that the difference between the average pause lengths among the Finns varied much more than it did among the Americans; as regards the average pause length, the group of Finns was more heterogeneous than the group of Americans.

Table 6. Pauses in teleph[illegible] conversation.

Pauses		Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.
Pause % of Total Turn Time		36.8	33.5	24.8	21.8	29.2
Average turn length (ms)	Mean	851	634	552	504	635
	Std. Dev.	339	130	138	62	167
Mean Std. Dev. of Pause Length		1046	582	482	424	634

The mean standard deviation of the pause length is approximately twice as high (1046 ms) for the Finn-Finn conversations as for any other group. This means that, when talking to one another, Finns use pauses of more varying length. This figure drops drastically when Finns speak with Americans (582 ms) but is still higher than the mean standard deviation of the pause lengths of the American groups (482 ms and 424 ms).

6.3. Turn

The number of the turns of speaking ranges from 64.2 (Finn-Finn) to 89.2 (Am-Am), the difference being 25 turns in 9 minutes and 30 seconds of conversation. This means that the Americans used 1.4 times as many turns as the Finns. The difference is statistically significant (U=1.5, z-score=-2.65, p<.01; Mann-Whittney). In Finn-Finn conversations the minimum number of turns is 51 and the maximum 77. For Am-Am conversations the minimum and maximum are 76 and 104 respectively. Table 7 shows the number of the

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turns, the mean turn lengths and the standard deviations of average turn lengths.

Table 7. Turns of speaking in telephone conversation.

Turns		Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.
Number of turns in 9 mins 30 secs		64.2	86.4	86.6	89.2	81.6
Average turn length (ms)	Mean	4491	3396	3326	3236	3612
	Std. Dev.	591	786	621	412	613
Mean Std. Dev. of Turn Length		5351	4415	3751	3863	4345

The mean length of the turns is significantly (U=1.0, z-score=-2.72, p<.01; Mann-Whittney) longer in the Finn-Finn conversations (4491 ms) than in the Am-Am conversations (3236 ms). The difference is 1.2 seconds, which means that Finns take speaking turns which are nearly 1.4 times as long as those of Americans. The turns in the conversations between Finns and Americans are nearly equal in length. The Americans took slightly longer turns in five cases out of eight; in the remaining three, Finns took slightly longer turns. The number and length of the turns in the Finn-American conversations are closer to those of the Am-Am conversations than to those of the Finn-Finn ones. For the number of the turns, the difference between the Finn-Am and Am-Am conversations is less than three as opposed to more than 22 between the Finn-Am and Finn-Finn conversations. The mean turn length differs by only about 160 milliseconds from the American-American mean length of turn and as much as 1095 ms from the Finn-Finn mean turn length. The number and length of the turns in the Finn-Am conversations are closer to those of the Am-Am than to those of the Finn-Finn ones.

The standard deviation of the average turn lengths is the highest in groups Finn-Am (786 ms) and Am-Finn (621 ms). The variation in average turn length is thus the highest in the groups involved in intercultural communication. Variation is at its lowest found in the Am-Am group (412 ms).

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Comparison of the mean standard deviation with the average turn length implies that variation in turn length within a conversation was high for every group. It is the highest with Finns talking to each other (5351 ms) and the lowest with Americans talking to Finns (3751 ms). The turns of Finns are generally longer and varied more in length than those of Americans.

6.4. Switching Pause

The number of the switching pauses is the highest, in the present material, when Americans talk to Finns (mean=55.6) and the second highest when Finns talk to Americans (mean=53.5). In Finn-Finn conversations the mean number of switching pauses was 47.4. When Americans talked to Finns they used an average of 52.3 switching pauses per 9 minutes and 30 seconds. Table 8 shows the occurrences, average lengths and standard deviations of switching pauses for each group of conversations. These figures become more meaningful when examined together with the number and length of turns (see Chapter 7).

As can be seen in Table 8, the average length of a switching pause varies greatly between some of the groups but generally very little within groups For Finn-Finn conversations, the average length of a switching pause is 920 ms, whereas for Am-Am conversations it is only 535 ms. The difference between these two extremes is 385 ms, which is nearly three times the standard deviation of the Finn-Finn average switching pause length and close to four times the corresponding Am-Am standard deviation. In

Table 8. Switching pauses in telephone conversation.

Switching pauses		Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.
Number of SwPs in 9 mins 30 secs		47.4	53.5	55.6	52.3	52.2
Average SwP length (ms)	Mean	920	582	628	535	666
	Std. Dev.	133	89	154	109	121
Mean Std. Dev. of SwP Length		780	456	471	437	536

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intracultural conversations, Finns use switching pauses which are 1.7 times longer than those of Americans. This difference is statistically significant (U=1.0, z-score=-2.72, p<.01; Mann-Whittney).

In intercultural conversations the average switching pause length of Finns (582 ms) and Americans (628 ms) is close to the intracultural figure of Americans (535 ms). The difference between the Finn-Am group and the Finn-Finn group is 338 ms as opposed to the 47 ms difference between the Finn-Am and the Am-Am group. In short, in intercultural conversations Finns use slightly longer switching pauses than Americans. Since, according to the definition adopted for switching pause (see Chapter 2), switching pauses are credited to the person who yields the turn, switching pause length indicates how long a pause the subject is allowed to take. As the decision to start speaking is made by the partner, these figures reflect the partner's eagerness to take the turn. Accordingly, the fact that the switching pauses of Finns are significantly shorter when they converse with Americans means that the Americans do not allow them to take longer pauses but take the turn instead. Similarly, the slightly longer average length of the switching pauses of the Americans in the Am-Finn conversations means that Finns allow slightly longer switching pauses for Americans. However, this difference is not significant (n=8, z-score=0.7001, n.s.; Wilcoxon).

As was mentioned earlier, the variation in mean switching pause length within each group is relatively small (see Table 8). However, the variation in the lengths of individual switching pauses is generally high, ranging from 430 ms (Am-Am) to 780 ms (Finn-Finn). These figures are roughly proportionate to the average length of switching pause: the longer the average switching pause is, the more the switching pauses vary in length.

6.5. Simultaneous Speech

Simultaneous speech can be divided into interruptive and non-interruptive simultaneous speech (see Defs 5a, 5b and 5c in Chapter 2.2.5). Simultaneous speech, as such, refers to the sum of these two components. Table 9 presents a break-down of the simultaneous speech occurrences and the percentages of total conversation time.

The average number of the occurrences of simultaneous speech in the Finn-Finn conversations (16.8) is lower than the corresponding American figure (24.2). Likewise, simultaneous speech as a percentage of the total time is lower for the Finn-Finn conversations than the other. The differences are obvious, but they are not statistically significant as determined by the Mann-Whittney U-test (U=7.0, z-score=-1.78, n.s.). What calls for special attention is the fact that both the occurrence and the percentage of simultaneous speech is the highest for Finns talking to Americans. In fact, in intracultural conversations, Finns get scores which are well below the average but, in intercultural conversations, these scores clearly exceed the average (for further discussion see Chapter 8).

Table 9. Simultaneous speaking in telephone conversation. n=occurrences during conversation, %=percentage of total conversation time.

Interruptive and non-interruptive simult. speech		Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.	Finns with Amer.
Simul-taneous speech	n	16.8	26.9	22.4	24.2	22.6
	%	1.07	1.71	1.26	1.36	1.35
Inter-ruptive simult. speech	n	6.7	12.9	10.8	9.9	10.1
	%	0.44	0.73	0.57	0.53	0.57
Non -inter-ruptive simult. speech	n	10.2	14.0	11.6	14.2	12.5
	%	0.63	0.98	0.69	0.83	0.78

The average number of the occurrences of simultaneous speech for Americans is slightly lower in intercultural (22.4) than intracultural conversations (24.2). Although suggestive, the differences in the simultaneous speech percentages and occurrences between the Finn-Am group and the Am-Finn group are not statistically significant (n=8, z-score=-.84, n.s.) as determined by the Wilcoxon Signed Ranks test.

For each group of conversations, interruptive speech accounted for a smaller portion of simultaneous speech than non-interruptive speech. The occurrence of interruptive simultaneous speech was the lowest for the Finn-Finn conversations (mean=6.7) and the highest for the Finn-Am conversations (mean=12.9). The Americans were slightly more interruptive in the intercultural conversations than in the intracultural ones. The percentages of interruptive simultaneous speech vary from 0.44% (Finn-Finn) to 0.73% (Finn-Am). The unweighted average for all groups is 0.57%.

For non-interruptive simultaneous speech the number of occurrences does not vary as drastically between the Finn-Finn (10.2) and the Finn-Am

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(14.2) groups, although these are still the two extremes. It is interesting to see that the occurrences of non-interruptive speech are fewer for the Am-Finn conversations (11.6) than for the Am-Am ones (14.2). This means that the Americans have interrupted Americans 1.2 times as often as they interrupted Finns. The Finns have a slightly higher non-interruptive speech percentage in the Finn-Am conversations than the Americans in the Am-Am ones and yet they have fewer occurrences. This indicates that the Americans tolerated clearly more simultaneous speech in intercultural conversations than in intracultural ones, and still kept their turns. The increasing occurrence of interruptive simultaneous speech from the Am-Am conversations to the Am-Finn ones implies that Finns tolerate less simultaneous speech; they have yielded the turn more easily than their American partners.

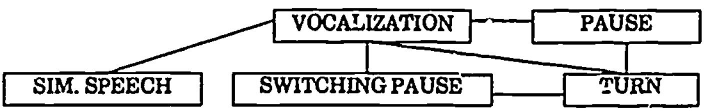
7. DISCUSSION

The results presented in Chapter 6 describe the values each of the selected parameters -- vocalization, pause, turn, switching pause and simultaneous speech -- received in the present study. However, these parameters should not be viewed only as separate items but rather as pieces of a well structured, though complex network. By examining the complexity of the parameter network, providing comparisons with the results of earlier studies, and evaluating the system as well as the whole study, this chapter fomrs a basis for the synthesis of the results.

7.1. On the Complexity of the Parameter Network

The results presented in the previous chapter describe the values which each of the parameters received in the present study. It should bo emphasized, however, that the parameters should not be viewed as separate items but rather as pieces of a network which is well structured, though complex. It is obvious, that none of the parameters of the present study, ie. vocalization, pause, turn, switching pause and simultaneous speaking, are totally independent. For examplo, if the vocalizations of a speaker are longer than those of his partner and yet their turns of speaking are of equal length, the pauses of the speaker are bound to be shorter than those of his partner. This, moreover, affects the amount of mutual silence.

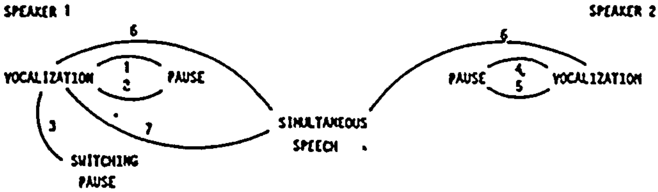
The above example shows that there are two types of relation between the parameters. First, changes in one parameter affect tho speaker's other parameters: for instance, the more vocalization, the less pause. The relations



of the parameters of one speaker can be simplified into the form where vocalization is undeniably the most essential component. It affects all other components directly. Together with pause and switching pause it forms a larger unit, which is turn. The fact that this model is a gross simplification of the complex network of relations cannot be overemphasized.

The second type of relation between the parameters consists of one parameter affecting the same or another parameter of the other person involved in the conversation. For the purposes of the present study, this set of relations is of special importance, since it is the only key to the explanation of turn-taking phenomena, which involve a great deal of interaction of parameters.

An example of a possible chain of interspeaker relations might be as follows. First, the speaker speaks producing pauses bounded by his vocalizations. Then he stops speaking to hear his partner's reaction. Thus, the absence of his vocalization (=switching pause) prompts his partner to vocalize and thereby take the turn. As soon as the speaker thinks he has understood his partner's reaction, he starts to speak again, although his



partner is not yet through with his vocalizing. This is recorded as simultaneous speech. If the speaker insists on speaking, his partner probably yields him the turn. This series of events is represented in the following diagram
in which the numbers indicate the sequence in time. This short example, involving only two speakers and two whole turns, illustrates the complexity of the parameter network.

Since the parameters of the present study form such an intricate network of features, it is both convenient and logical to group together parameters which are most closely related and draw conclusions from the resulting synthesis. This will be done in Chapter 8.

7.2. Comparison with the Results of Earlier Studies

As was mentioned above when parameters for the present study were selected (see Chapter 2.3.), there are a great number of studies of conversation chronography which have parameter definitions similar to the ones used in the present study. Thus, a comparison with the results of other studies is possible. It should be noted, however, that although the theoretical definitions of the parameters are similar, there are differences in the accuracy and means of measurement as well as in the experimental procedures. These differences need to be taken into account when the results are compared. There are numerous studies of speech chronology, most of them concentrating on pausology or speech rate (in words). The data for these studies has regularly been elicited by means of reading texts in different languages or narrating stories. Since the present study does not take speech rate into account and since reading and narrative monologues are not natural

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forms of conversational communication, such reports are not discussed here. Furthermore, since the present study concentrates on telephonic conversation, studies involving similar forms of communication are given special attention.

According to Jaffe and Feldstein (1970:29), one of the earliest studies on telephone conversation chronography was reported in 1938 by Murphy and Norwine in their study which was concerned mainly with the prediction of turn changes and vocalization timing. Jaffe and Feldstein (1970) also carried out tests in which the speakers could not see each other. In these tests the members of the dyad were separated by a screen. It could be argued that it is a less natural situation than the telephone: in telephone conversation the machine functions as a device to carry the message, whereas a screen is only a constraint, since it only affects visibility.

Brady (1968) studied conversation chronography in the telephone from a probabilistic point of view. His interest lay mainly in predicting how large a proportion of the time both speakers tried to talk at the same time. The results were used in the design of radio/telephone communication lines. Brady's findings support the supposition that there is generally little simultaneous speech -- speakers tend to talk in turns (Brady 1968).

Beattie (1979, 1983) recorded natural telephone conversations and carried out some chronographical measurements of the recordings. Beattie used definitions very similar to those used in the present study. Although Beattie does not provide a mean figure, it seems that the telephone conversations analyzed in his study were shorter, since the calls were telephone directory inquiries. Beattie shows that even though visual clues play an important part in turn yielding/taking, they are not necessary for smooth turn exchange and efficient information flow. Furthermore, Beattie shows that the chronography of telephone conversations does not significantly differ from that of face-to-face conversations. A pause threshold of 200 ms was used. Since the tapes were transcribed, filled pauses were differentiated from other vocalizations (Beattie 1979, 1983).

Brotherton's (1979) study involved dyadic conversation, although not via the telephone. It is considered here because it provides an interesting point of reference as regards the mean length of pauses and switching pauses. The pausologies of two different social groups, the lower working class and the upper middle class, were compared. The data consisted of twenty 10-minute dyadic conversations between adult strangers. A pause threshold of 250 ms was used and the recordings were transcribed to make it possible to carry out lexical analysis and to distinguish filled pauses from other vocalization. Brotherton (1979) concludes among other things that there are differences in pausing between different social classes.

Oreström (1983) studied turn-taking in dyadic conversations between native speakers of English. The data consisted of ten face-to-face conversations, four of which had been recorded surreptitiously. The emphasis in the study was on the relation between turn-yielding,

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transition-relevance places, and linguistic properties. Oreström measured turn length, listener activity, simultaneous speech and interruption. Apart from the number of turns per minute, the figures presented in the study are not comparable with those of the present study since Oreström adopted a linguistic approach rather than a non-linguistic one: all quantitative description is given in utterances, sentences, tone units, and words.

The study of Welkowitz, Bond and Feldstein (1984) was conducted on dyads of eight-year-old Hawaiian boys and girls of either Caucasian or Japanese descent. The subjects engaged in face-to-face conversation for 20 minutes. As many as 64 such conversations were analyzed. In their study Welkowitz et al. found evidence that both ethnicity and gender cause variation in the temporal patterning of conversational speech. A computer-based system was used for the investigation of the time patterns (Welkowitz et al. 1984:180). The system called WELMAR resembled the AVTA, using a mainframe computer (PDP-12) and two separate sound channels. In their description of WELMAR, Martz and Welkowitz (1977) define vocalization, pause, turns,switching pause and simultaneous speech in much the same way as did Jaffe and Feldstein (1970). Thus, the results presented by Welkowitz et al. are quite different as regards the number of the turns: the frequency of speaker switches is about one half of those Finns. A possible explanation could that Welkowitz et al. studied children's face-to-face conversation, whereas the present study is concerned with telephone conversations between adults. The figures presented in Table 10 are averages of males and females of the same descent (see Welkowitz et al. 1984:180).

Tiittula (1985a, 1985b) has studied turn switching in three-, four-, and five-person conversations with different levels of formality. Tiittula's subjects were all Finns. Tiittula videorecorded the conversations for later analysis of visual clues of turn changing. Since the emphasis of the work was on turn switching in general, not on pausology as such, pauses of whole conversations were measured manually up to the accuracy of half a second using a stop watch. For more accurate results, twenty-second samples of the speech of each speaker were instrumentally measured. (Tiittula 1985a, 1985b). The values presented in Table 10 are computed averages of the figures Tiittula measured from the three conversations (see Tiittula 1985b:107,115).

In the present study, pause percentage is not calculated of total conversation time but of total turn time. This means that pause percentage indicates how large a portion of the total turn time each speaker spend pausing.

Table 10. Comparison of the results of the present study with those of earlier studies. V%=Vocalization Percentage, Vx=Mean Length of Vocalization, P%=Pause Percentage. Px=Mean Length of Pause, T#=Number of Turns, Tx=Mean Length of Turn, SwPx=mean Length of Switching Pause, Sim%=Percentage of Simultaneous Speech. See text for further details.

	V%	Vx (ms)	P%	Px (ms)	T# per min	Tx (ms)	SwPx (ms)	Sim %
Brady 1968	39.5	1170		500			400	4.[illegible]9
Jaffe and Feldstein 1970		1640		660			770	3.29
Beattie 1979							489	
Brotherton 1979 Upper Middle Class				821			1024	
Brotherton 1979 Lower Working				594			939	
Oreström 1983					6.0			
Welkowitz et al. 1984 Caucasians		945		635	3.3	4525	865	
Welkowitz et al. 1984 Japanese		1005		570	3.4	3910	840	
Tiittula 1985			18.2	695			1053	
This study Finns with Finns	29.2	895	36.8	851	6.8	4491	920	1.1
This study Americans with Americans	36.5	998	21.8	504	9.4	3236	535	1.4

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7.3. Evaluation of the ACTS

To provide for an objective evaluation of the Automatic Conversation Timing System (ACTS) developed for the present study, its reliability was tested with a simple split model reliability test using SPSS-X (SPSS-X User's Guide 1983:717). The test was carried out in two parts to estimate the reliability of the factors involved: the machine factor (=software and hardware) and the compound reliability of the system, ie. the human factor together with the machine factor.

First, to evaluate the machine factor an one-minute excerpt of four conversations was measured twice without changing the calibration levels. The SPSS-X was then used to compute the reliability estimates, which are presented in Table 11. The results of the measurements are shown in Appendix E.

Table 11. Reliability estimates of the ACTS.

		Machine Component	Human and Machine Component
Vocalization	% of total time	.9994	.9940
	Mean length (ms)	.9914	.8195
	Std deviation (ms)	.9993	.9726
Pause	% of total time	.9996	.9681
	Mean length (ms)	.9968	.7837
	Std deviation (ms)	.9998	.9100
Turn	Number of times	.9656	.9583
	Mean length (ms)	.9905	.9858
	Std deviation (ms)	.9987	.9975
Switching Pause	Number of times	.9880	.9791
	Mean length (ms)	.9880	.9467
	Std deviation (ms)	.9980	.7772
Totals as percent of total time	Vocalization	.9997	.9876
	Mutual silence	.9997	.9876
	Switching pause	.9991	.9901
	Simultaneous speech	.9903	.9654

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The compound factor refers both to the calibration stage carried out by the human operator of the system and to the machine factor. Four one-minute excerpts were measured again. Before each measurement the system was reset -- all settings were set to zero -- and the process of calibration was executed with great care. The SPSS-X used these results together with the results of the first set of measurements that were carried out to evaluate the overall reliability factor. Table 11 shows the reliability estimates.

The reliability figures clearly indicate that the most critical part of the system is the human operator. The preamplification of the signal for each channel needs to be carefully adjusted to avoid erraneous results. The reliability of the machine component is good.

Although the system was primarily designed for the purposes of the present study, it was built to handle four separate channels. Provided that the cross-talk problem which inevitably rises in panel discussion performed around one table can be solved, for instance by using a cancellation network similar to the one employed by Jaffe and Feldstein in the AVTA, there is no reason why the ACTS could not be used to analyze other than dyadic conversations.

7.4. Evaluation of the Study

The objectives of the present study were twofold. First, it was aimed at analyzing possible chronographic differences in the telephone behaviour of Finns and Americans, with special emphasis on the use and tolerance of silence. The second objective of the study evolved as a natural consequence of the first: an automatic measuring system was necessary for the measurement of several parameters at the same time.

The number of subjects (four Finns and four Americans) is small. Therefore, no definite conclusions can be drawn on the basis of the results, even though the results indicate statistical significance. The subjects were not selected randomly. The groups were not completely homogeneous: the group of Finns included two students, whereas there were no students in the group of Americans. Not all subjects in the American group were true Americans in the sense of living there presently or even in the past several years. Although they were all born in the United States, one of them had spent most of her life in Canada. The Americans had lived in Finland for a period which varied from several months to a couple of years. This means that their communicative behavior may have changed and, thus, may not represent those of true Americans.

Although the Finns were selected mainly on the basis of their supposed fluency in English, there were apparent differences in their command of conversational English. This subjective opinion, which was formed on the basis of listening to the recorded conversations a number of times, is supported by short informal interviews with the Americans, who -- unaware of the opinions of the other Americans -- all promoted the same view. The effects of these differences in communicative competence have not been taken into account in the analysis of the results.

No sociodemographic variables other than nationality have been taken into account in explaining the differences. Since both groups consisted of two males and two females, and since the conversations were distributed equally among both sexes, sex is not of importance in the overall results. As regards socioeconomic status and age, the groups were not quite homogeneous, since the group of Finns included two students, and since one of the Americans was approximately 13 years older than the average age of the Finns. Furthermore, in one case, a Finnish student had to converse with his teacher, which may well have affected his behaviour.

The subjects were aware of the recording. Although they did not know exactly what was to be measured, they understood that their use of language was to be analyzed. According to Oreström (1983:43), "we have no right to assume that it may not have an effect on their interactional behaviour, not even if they are instructed to behave naturally." Furthermore, the subjects may have had different amounts of experience in telephone conversation. This is undoubtedly so with those of the Finns who use the telephone in their work: the Finns who are staff members at the Department of English probably have to speak English on the telephone daily. Whether this could drastically affect the results is open to question. According to Beattie (1979), experience does not seem to affect the chronological patterning of vocal behaviour, whereas Holmes (1981) concludes in her study of children's telephone conversations that, at least up to the age of 8, the success of interaction depends on the conversants' experience with the telephone.

The statistical analyses did not employ time series analysis, which would have provided more accurate information of the phenomenon of accommodation to the other speaker's rhythm. The statistical analyses were limited to the calculations of the means and standard deviations and to the establishment of the minimums and the maximums. Statistical significance was tested using two nonparametric tests of significance, namely Wilcoxon Matched Pairs Signed Ranks and Mann Whitney U-test. Thus, the statistical analysis of the data was by no means comprehensive.

The comparisons with the results of earlier studies showed that, in spite of an aim towards compatibility, the results are not necessarily comparable because of the apparent differences in the experimental procedures and the various methods of measuring the variables.

8. SYNTHESIS OF THE RESULTS

As has been pointed out in Chapter 7.1., the parameters of the present study are not independent: affecting each other directly or indirectly they form a complex network of interconnected variables. It is reasonable to assume that some parameters are more closely interlinked than others. This chapter illuminates the relatedness of the variables through combining and comparing the results of pairs of parameters which are chosen on the basis of the definitions to be the most closely related.

8.1. Vocalization and Pause

The most obvious pair is, of course, the one formed by the two basic components of a turn: vocalization and pause. A comparison of vocalization and pause percentages produces additional information to that presented in Chapter 6. Figure 9 illustrates the vocalization and pause percentages of the groups of conversations. The precise numeric values are given in Tables 5 and 6. Evidently, certain trends can be found. For the vocalization percentage, the trend is obvious: vocalization percentage increases from Finn-Finn to Finn-Am to Am-Finn to Am-Am conversations; when talking to Americans, Finns speak more than they do when talking to other Finns. At the same time, when talking to Finns, Americans vocalize less than when talking to other Americans. Thus, in intercultural conversations, the vocalization percentages of Finns and Americans approach the overall average. This could be seen as a sign of adaptation to the other speaker's communicative behavior. (For evidence of adaptation to the partner's conversation chronography, see e.g. Kendon 1982; Cappella 1985; Parks 1985.)

As regards pause percentage, the trend is less obvious, but still clear. The pause percentage of the Finn-Finn and the Am-Am conversations are further apart than the vocalization percentages. In intercultural conversations, both groups approach the overall average but the difference remains much larger than for vocalization. The differences in the percentual amounts of vocalization and pause are remarkable: in all conversations Finns have a higher pause than vocalization percentage; for Americans, the opposite is the case: they have a lower pause than vocalization percentage. Another interesting feature regarding the pause percentage of the Finns is that in the Finn-Finn conversations it is higher than the vocalization percentage in the Am-Am conversations. Percentually, Finns vocalize less and pause more, whereas Americans vocalize more and pause less.

The mean lengths of vocalization and pause reveal several interesting features of the communicative orientation of Finns and Americans. Figure 10 is a graphic representation of the mean lengths of vocalization and pause. In all groups of conversations the average length of vocalization was longer than that of pause. In the Finn-Finn conversations the difference between

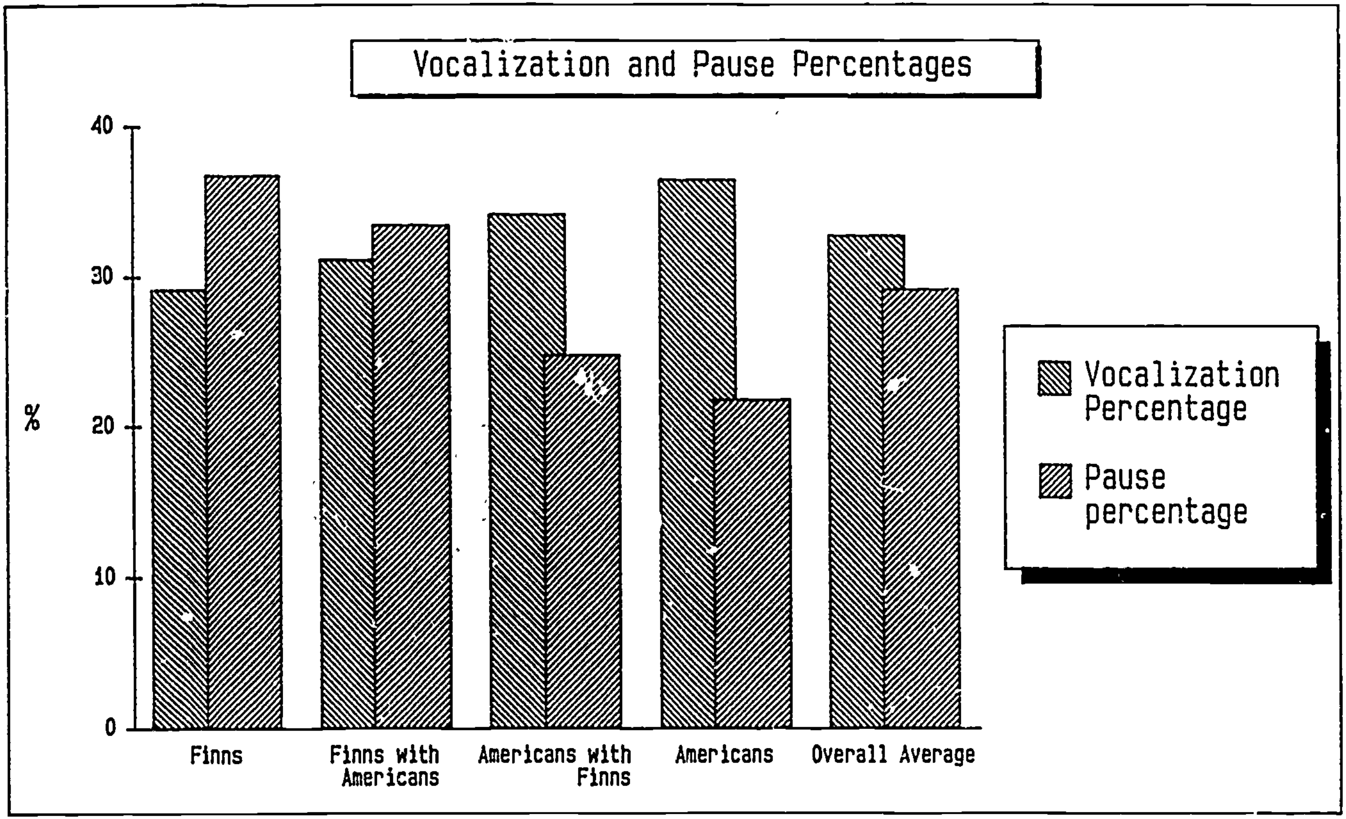

Figure 9. Vocalization and pause percentages.

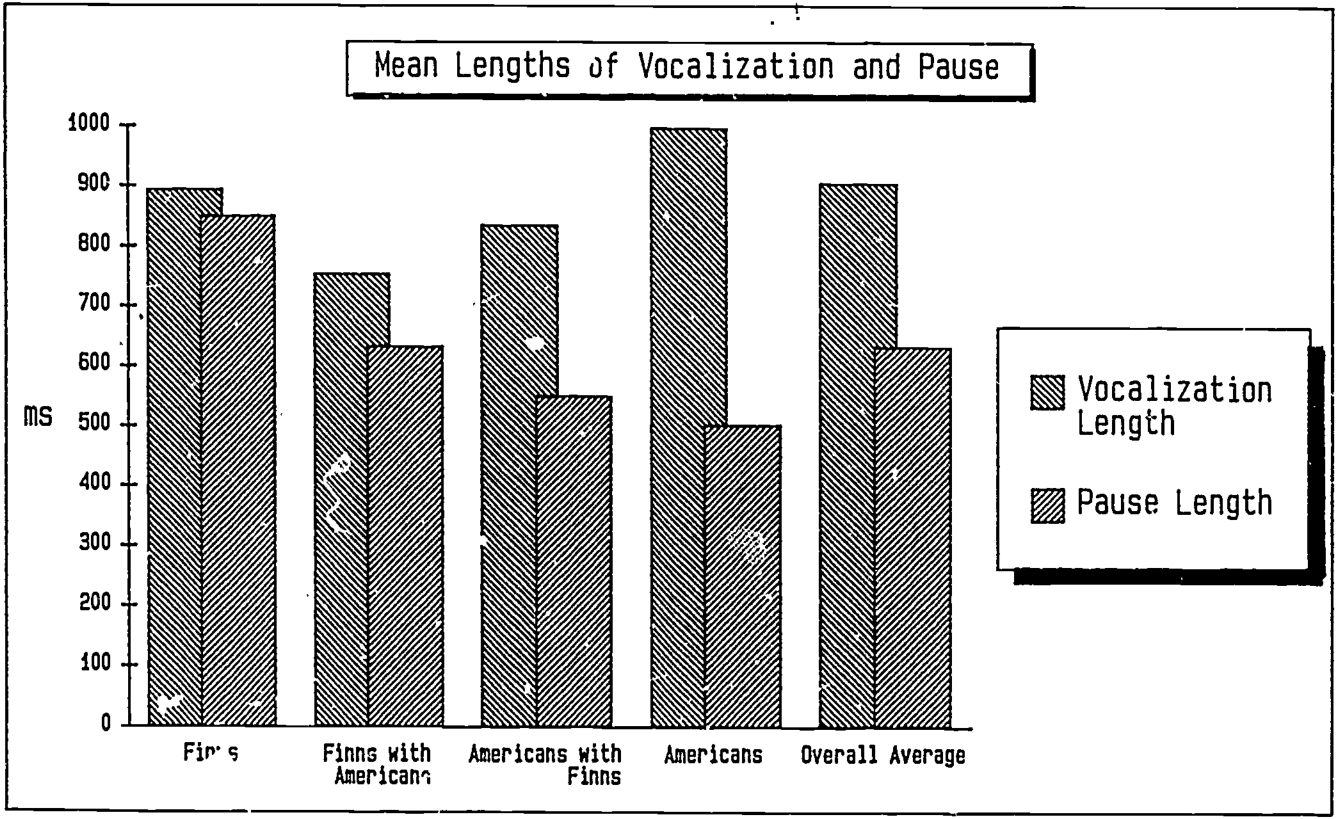

Figure 10. Mean lengths of vocalization and pause.

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these two variables was the smallest (44 ms), in the Am-Am conversations it was the largest (494 ms).

For Finns, the difference between the mean lengths of vocalization and pause increases in intercultural conversations, whereas for Americans the difference decreases. Here, too, the question of adaptation arises. The fact that the mean length of vocalization drops so radically when Finns talk to Americans makes direct comparisons rather difficult. What is important, though is the ratio between vocalization and pause. If the vocalization value is divided by the pause value, the result is a figure that indicates the ratio between the two parameters. The vocalization/pause ratios are shown in Table 12, where the vocalization values are divided by the corresponding pause values, thus yielding a ratio x:1. If the ratio is one, the figures are equal; if x < 1, then vocalization is smaller than pause; if x > 1 then vocalization is greater than pause. The table shows that in the Finn-Finn conversations, the vocalization mean length is only slightly higher than the

Table 12. Vocalization and pause ratios.

Vocalization/ Pause Ratio	Finns	Finn-Am	Am-Finn	Amer.	Mean
Percentages	0.793	0.931	1.379	1.674	1.194
Mean Lengths	1.051	1.191	1.514	1.980	1.434

pause mean length (1.05:1). In the Am-Am conversations the mean length of vocalization is nearly twice as long as the pause mean length (1.98:1).

It should be noted (see Figure 10 and Table 12) that in intercultural conversations both the vocalizations and pauses of the Finns decreases in length, yet the ratio approaches that of the Americans. The fact that both figures decrease is bound to affect the average turn length of the Finns. This finding will be discussed in connection with turns and switching pauses in Chapter 8.2.

Three major conclusions can be drawn from the comparisons made above. First, Finns vocalize less than they pause but the average length of vocalization is slightly higher. Second, Americans vocalize 1.7 times more than they pause and the average length of vocalization is nearly twice as long as that of pause. Third, in intercultural conversations the vocalization/pause ratios approach that of the other culture.

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8.2. Turns and Switching Pauses

According to the definitions of the parameters adopted for the present study, turns usually consist of vocalizations with pauses between them, with an optional switching pause at the end. Studies on switching pauses have shown that there are cultural differences in the use of pause as a marker of turn yielding (see eg. Scollon, 1983). According to the definition of turn, it is an interval between two successive speaker switches, ie. the time that lapses from the moment one person starts talking alone to the moment another person starts talking alone. Since pauses were defined as periods of silence linked together by the vocalizations of the same speaker, the last pause before a speaker switch is not regarded as a pause (or, within-turn pause) but as a switching pause which is credited to the speaker who yields the turn. Thus, switching pause figures in the present study reflect the activity, or response latency, of the speaker's partner; switching pause times indicate how long a switching pause a speaker was allowed to take before the other speaker took the turn by starting to speak.

A comparison of the occurrences of turns and switching pauses shows that quite often there is no discernible switching pause between turns. Figure 11 represents these occurrences graphically. It is evident that the difference in the number of turns is great between intracultural conversations. In intercultural conversations the number of turns approaches that of the Am-Am conversations. Naturally, the difference between the number of turns in intercultural conversations cannot be greater than one: in dyadic conversation the speakers either have an equal number of turns or one speaker has one turn more than the other. This is because, due to the adopted definition of turn (see Def 3), it is not possible for a speaker to have two successive turns.

Further investigation of Figure 11 shows that the number of switching pauses is insignificantly higher in the Am-Am conversations than it is in the Finn-Finn ones (U=7.0, z-score=-1.76, n.s.; Mann-Whittney), although for the Americans the number of turns is significantly higher (U=1.5,z-score=-2.65, p<.01; Mann-Whittney). The Turn/Switching Pause ratio varies according to the type of conversation. These ratios are presented in Table 13. In more than seven cases out of ten a turn in Finn-Finn conversation includes a switching pause. In Am-Am conversation, switching pause is present in fewer than six cases out of ten.

The mean lengths of turns and switching pauses vary greatly between Finns and Americans. As Figure 12 shows, both switching pauses and turns are longer in Finn-Finn than in Am-Am conversations. Both differences proved to be statistically significant (see Chapter 6). Although the turn lengths are almost identical in the intercultural and the Am-Am conversations, the switching pauses are slightly longer when Americans talk to Finns. Although not statistically significant, this difference suggests that

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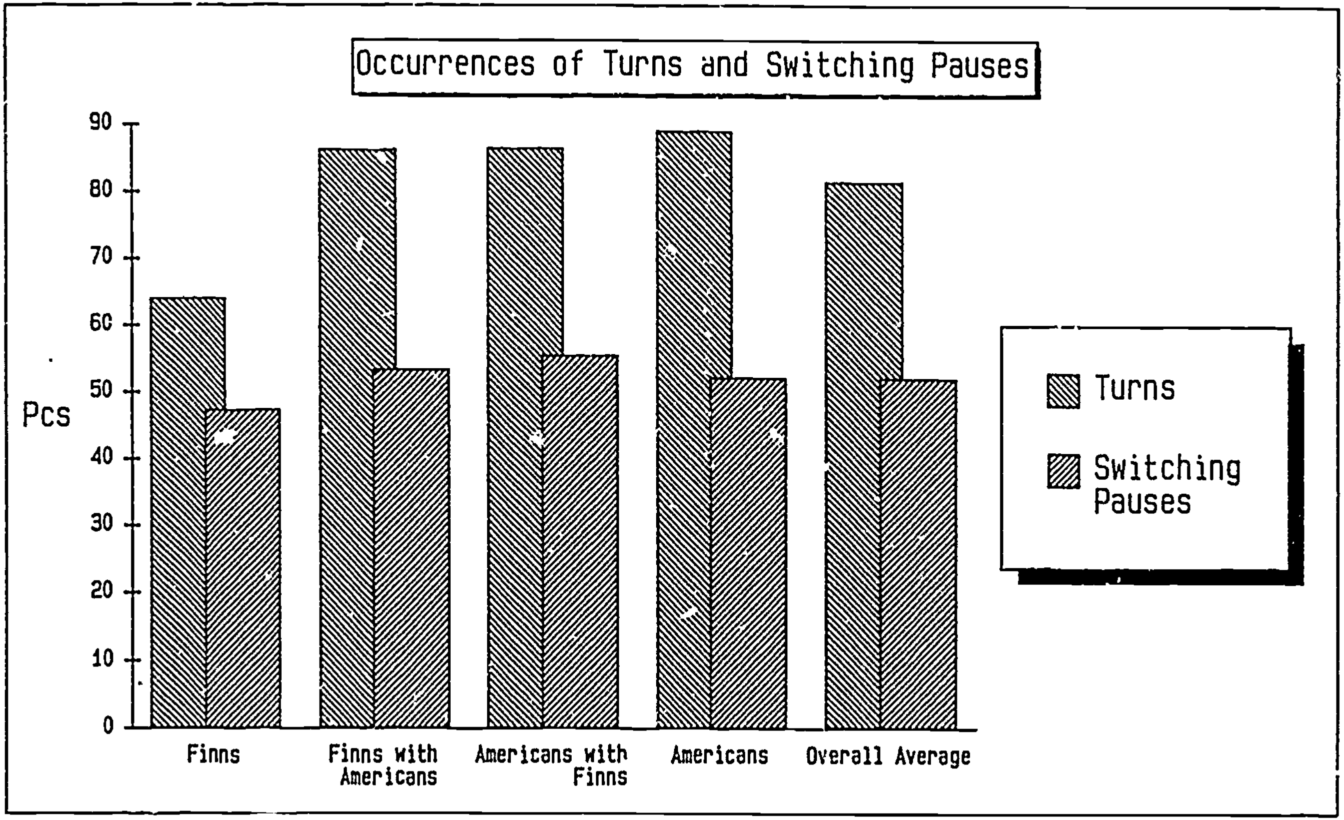

Figure 11. Occurrences of turns and switching pauses. Conversation time is 9 minutes and 30 seconds.

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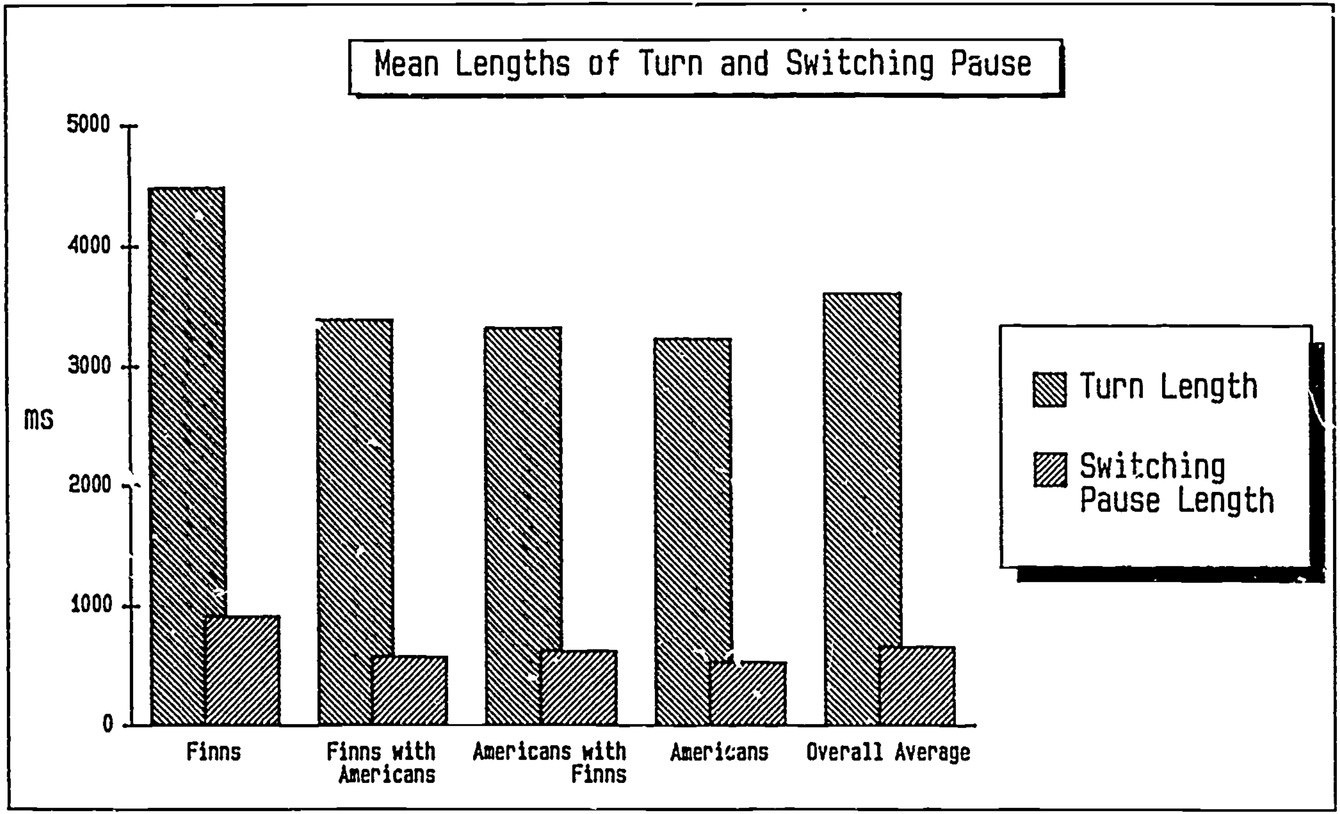


Figure 12. Mean lengths of turns and switching pauses.

Finns allow Americans slightly longer switching pauses than are allowed by other Americans.

Table 13. Turn and switching pause ratios.

Turn/Switching Pause Ratio	Finns	Finn-Am	Am-Finn	Amer.	Mean
Percentages	1.354	1.615	1.558	1.705	1.563
Mean Lengths	4.882	5.835	5.296	6.048	5.423

The ratio between the turn and switching pause lengths reveals that the differences are once again greater between intracultural than within intercultural conversations. The values of both Finns and Americans come closer to the American intracultural value than to the Finnish one. Table 13 shows the turn and switching pause ratios.

To sum up, the synthesis of the turn and switching pause figures resulted in four findings. First, in intracultural conversations Finns take longer turns and use longer switching pauses than do Americans. Second, in intracultural conversation Finns spend more turn time for switching pause than do Americans. Likewise, when Finns converse with other Finns, a turn includes a switching pause more often than when Americans talk to one another. Third, in intercultural conversations these differences become smaller. Fourth, it is the Finns who change their behaviour rather than the Americans.

8.3. Simultaneous Speech

The amount of time that the speakers vocalized simultaneously, expressed as a percentage of total time, is small, as was expected. As shown in Chapter 6, simultaneous speech percentages ranged from 1.07% (Finns talking to Finns) to 1.71% (Finns talking to Americans). It is evident that something went wrong with the delicate mechanism of turn switching when the Finns spoke English to the Americans. Whether this was because of the language, cultural differences in turn taking behaviour, or because of other sociodemographic variables is difficul to judge. A closer study of the ratios of interruptive and non-interruptive speech may reveal something of the quality of simultaneous speech and thereby suggest why the simultaneous speech percentage of the Finns was so high in intercultural conversations. Figure 13 gives a graphic illustration of the percentages of simultaneous speech in various conversations.

The proportions of the occurrences of simultaneous speech (see the graphic representation in Figure 14) are similar to the proportions of percentual values (see Figure 13). This means that there are not great differences in how simultaneous speech is divided between interruptive and non-interruptive simultaneous speech. In both cases, the greatest values are to be found in the speech of Finns when they talk to Americans. Likewise, in both cases, the smallest values are found for Finns talking to each other.

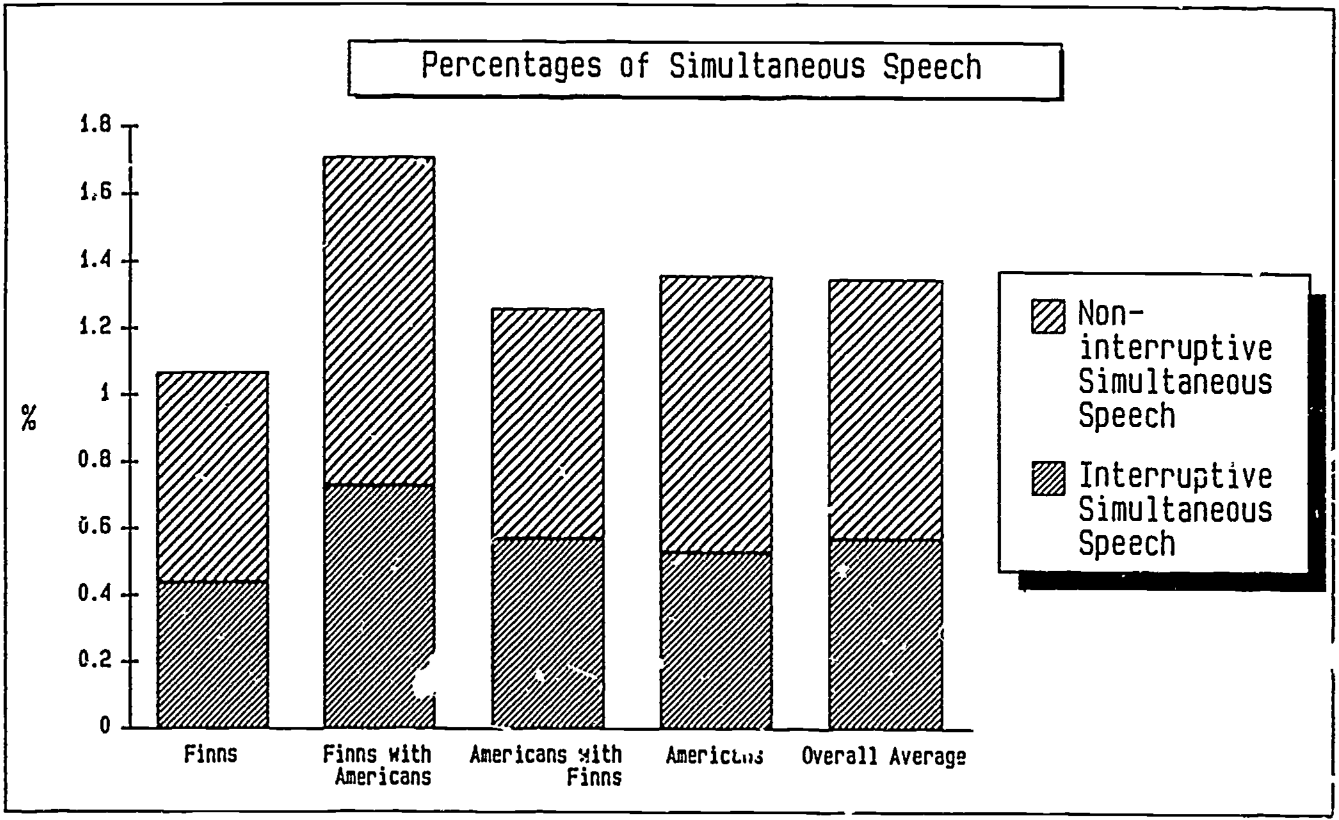
Computation of the ratios for the interruptive versus non-interruptive simultaneous speech values produces figures that are easier to compare. Table 14 shows these ratios. A higher ratio means a relatively larger proportion of interruptive simultaneous speech. In all cases, the ratio is less than 1 indicating that there was more non-interruptive than interruptive simultaneous speech. It is evident that a relatively larger proportion of the occurrences of simultaneous speech is interruptive in intercultural conversations. For the Finns in intercultural conversations the ratio was .921, while for the Americans in the same conversations it was .931. Thus, nearly every other occurrence of simultaneous speech in the intercultural

Table 14. Interruptive simultaneous speech and non-interruptive simultaneous speech ratios.

Int./Non-int. Sim. Ratio	Finns	Finn-Am	Am-Finn	Amer.	Mean
Percentages	.698	.745	.826	.638	.731
Mean Lengths	.657	.921	.931	.697	.803

conversations led to a turn shift. In the intracultural conversations the ratios were lower: .657 (Finns) and .697 (Americans). This supports the idea that the turn-taking system malfunctions in intercultural conversation. Because the differences between intercultural and intracultural conversations are so obvious, the unweighted average figure is not very descriptive.

Comparison of the ratios of the percentages of the two types of interruptive speech reveals that of the total conversation time the Americans, when talking to the Finns, used more in interruptive simultaneous speech relative to non-interruptive than when talking to each



igure 13. Percentages of simultaneous speech.

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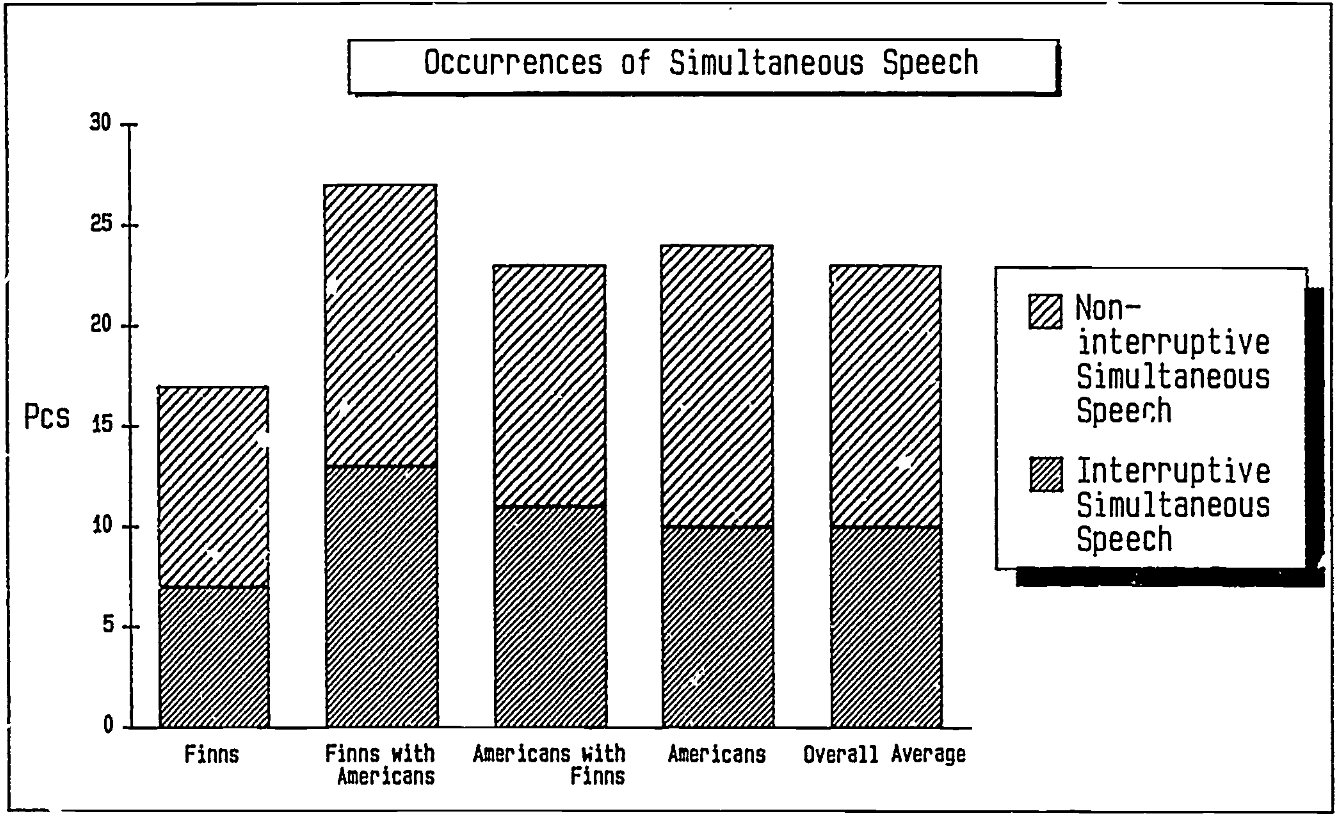

Figure 14. Occurrences of simultaneous speech. Conversation time is 9 minutes and 30 seconds

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Table 15. Mean lengths of interruptive and non-interruptive simultaneous speech in telephone conversations.

Mean lengths of simult. speech	Finns	Finn-Am	Am-Finn	Amer.	Mean
Interruptive (ms)	374	323	301	305	321
Non-interruptive (ms)	352	399	339	333	355

other. Again, the ratio is higher in intercultural conversation, providing further evidence for the malfunctioning of the turn-taking system.

Computation of the mean lengths of interruptive and non-interruptive simultaneous speech provides information about the tolerance of simultaneous speech. The mean lengths (see Table 14) are calculated from the average total time of analyzed conversation (570 seconds), the percentage of each type of simultaneous speech, and the number of the occurrences of each type.

The figures in Table 15 indicate that both types of simultaneous speech are longer for the Finns than for the Americans. Thus, a number of conclusions can be drawn. First, in intercultural conversation, the occurrences of simultaneous speech are fewer but longer than in American-American conversation. Second, the mean length of interruptive speech decreases in intercultural conversation. This indicates that in such conversations speakers do not tolerate extended simultaneous speech but rather yield the turn. A complementary interpretation of this phenomenon is that Americans tolerate longer simultaneous speech from each other than they do from Finns.

Third, the average length of non-interruptive simultaneous speech increases in intercultural conversation. This, together with the fact that the number of the occurrences increased when the Finns talked to the Americans, might indicate that the Finns used more back-channel utterances produced while the other person spoke. The Americans, on the hand, may have used back-channels items that were timed to match the pauses of the other speaker. This would explain why the number of the turns was greater in all the conversations in which the Americans took part. Back-channel would be a natural way to assure flawless information transfer in conditions where one party of the dyad has to speak a language other than his/her mother tongue. The results from this study suggest that Finns use more back-channel in intercultural than in intracultural conversation. The fact that there is an opposite shift in the mean lengths of interruptive and non-interruptive speech tolerated by Finns as opposed to Americans would suggest that the clarification of the problem of radically increased occurrences of simultaneous speech when Finns talked to Americans will require a more detailed analysis of the whole phenomenon -- probably one applying discourse analysis in its full power.

8.4. Communicative Behavior in the Light of the Results

Since the number of the subjects was only eight and the total number of telephone conversations only twenty, it is clear that the results of the test cannot be generalized to cover all aspects of the communicative behavior of Finns or Americans -- not even communication via the telephone. This study should be seen as a pilot study aimed at testing the Automatic Conversation Timing System, ACTS. However, since the results proved to be relatively clear-cut -- sizeable differences between the groups with only small standard deviations within groups -- they clearly imply the existence of differences in the patterning of communicative behavior between Finns and Americans. The following paragraphs list the major differences as indicated by the results of the present study.

As regards vocalization and pause, there is a major difference between Finns and Americans: Finns vocalize less than Americans; accordingly, Finns take longer and more frequent pauses than Americans. In intercultural conversation, both Finns and Americans adjust to the other culture's conversation chronography: differences diminish drastically.

The number of turns per conversation is quite different in American as against Finnish intracultural conversation. Apparently, Americans use more back-channel. Finns tolerate longer switching pauses and take longer but fewer turns. In intercultural conversation Finns accommodate more clearly than do Americans.

As a whole, there is little simultaneous speech. In intracultural conversation Finns do not speak simultaneously as often as Americans. In intercultural conversation, however, the length and frequency of both interruptive and non-interruptive simultaneous speech nearly doubles for Finns. This can be taken to imply a malfunction of the turn switching mechanism, which is in accordance with the cross-cultural communication strategies of Finns, as pointed out by Lehtonen and Sajavaara (1985:196; see also chapter 2.1). Another explanation for why the Finns spoke so much simultaneously and interrupted so often, when talking to the Americans, is that they used more back-channel than when talking to Finns in Finnish. However, unlike the Americans, the Finns did not manage to synchronize their back-channel to match the pauses of the other speaker.

Lehtonen and Sajavaara (1985:193-194) claim that, compared to other cultures, Finns tolerate more silence. The findings of the present study support this view. Finns have a higher pause percentage than Americans and they tolerate longer switching pauses. Furthermore, computation of the total percentage of silence (excluding switching pauses) reveals obvious differences. Figure 15 shows a comparison of how the total conversation time is divided in intracultural conversation. For 56% of the total time at least one person vocalizes in Finn-Finn telephone conversation. In American-American conversation, the corresponding figure is 70%, giving a difference of 14%. Finns use 15% of total conversation time in switching pauses, Americans use only 10%. The remaining mutual silence makes up 29% in Finn-Finn conversation and only 20% in American-American conversation. In intercultural conversation the differences diminish, presumably as a result of accommodation to the chronological patterning of the partner.

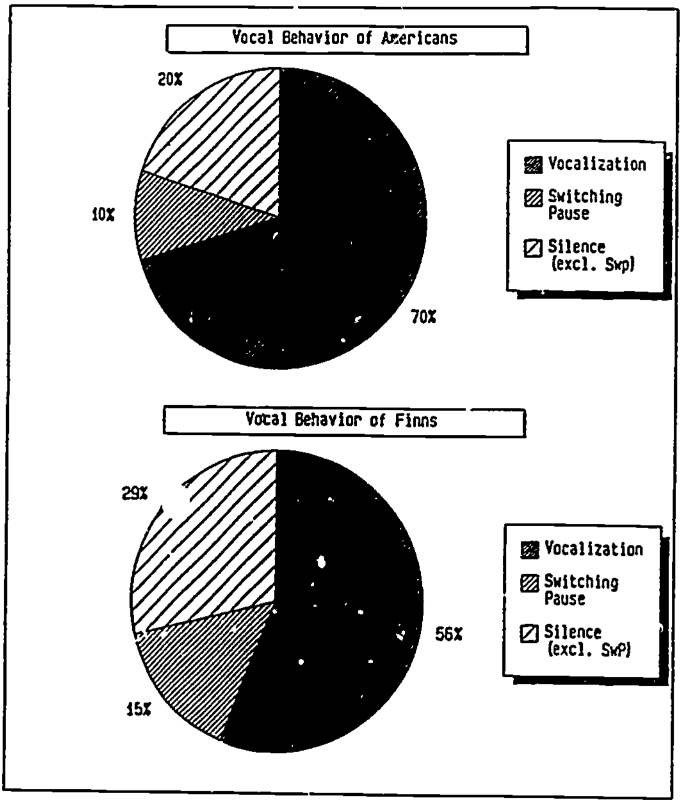

Figure 15. Vocal behavior of Americans and Finns in intracultural conversation. Silence refers to mutual silence excluding switching pauses. Vocalization refers to total time of vocalization, ie. at least one person speaking.

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9. CONCLUSION

This study assesses the conversation chronography in dyadic intercultural and intracultural conversation. The data consists of twenty telephone conversations conducted by four Finns and four Americans. When talking to another Finn, the Finns used Finnish; in all other conversations English was spoken. The conversations were recorded and analyzed using a computer based Automatic Conversation Timing System (ACTS). Five parameters were measured: vocalization, pause, turn, switching pause and simultaneous speech.

A number of systematic differences were found to exist in the chronological patterning between intracultural and intercultural conversations. First, the Finns used longer and more frequent pauses than did the Americans, whose vocalization percentage of the total time was higher. Second, the Finns took fewer but longer turns. This may be due to the fact that the Americans apparently used more back-channel synchronized to fit in the pauses of the other speaker. Third, the Finns used more frequent and longer switching pauses. This means that the Finns allowed the other speaker a longer pause before they assumed it was time for them to take the turn. Fourth, when talking to the Americans, the Finns had a strikingly high portion of simultaneous speech. This may be partly a symptom of the malfunctioning of the turn-taking mechanism, and partly the result of increased use of mistimed back-channel. Fifth, the Finns tolerated silence longer and more frequently than did the Americans. Sixth, in intercultural conversation both nationalities showed evident signs of accommodation to the other culture's time patterns. This adaptation was more obvious for the Finns than for the Americans.

Conversation chronography -- when measured objectively -- reveals differences in cross-cultural and cross-linguistic communication. The present study shows that a computer based conversation chronography analysis system is applicable to the task of assessing the patterning of vocal behavior in conversation. The method used proved to be relatively reliable and definitely faster than the traditional transcript and stopwatch methods, which undeniably have their advantages. For the time being, no automatic measurement systems can accommodate all aspects of discourse analysis, since semantics is ruled out. Computer-assisted discourse analysis is yet to come. Meanwhile, an automatic conversation timing system can serve as a time-saving tool in the attempt to distinguish and assess differences in conversational vocal behavior.

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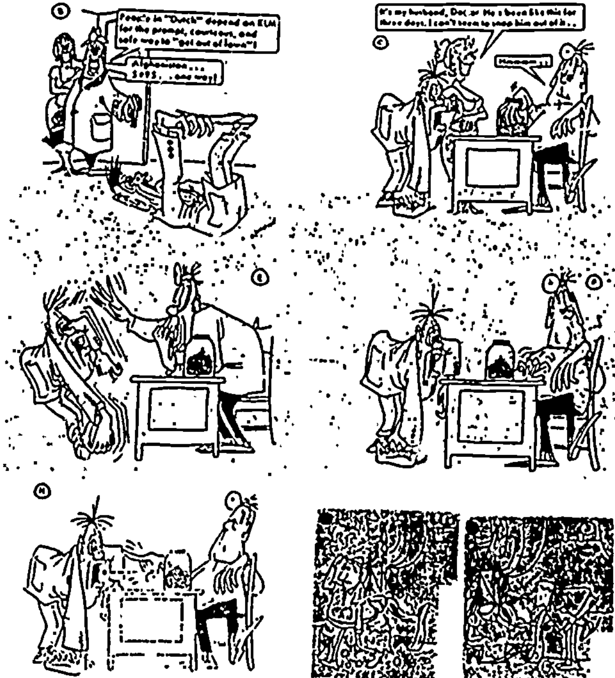

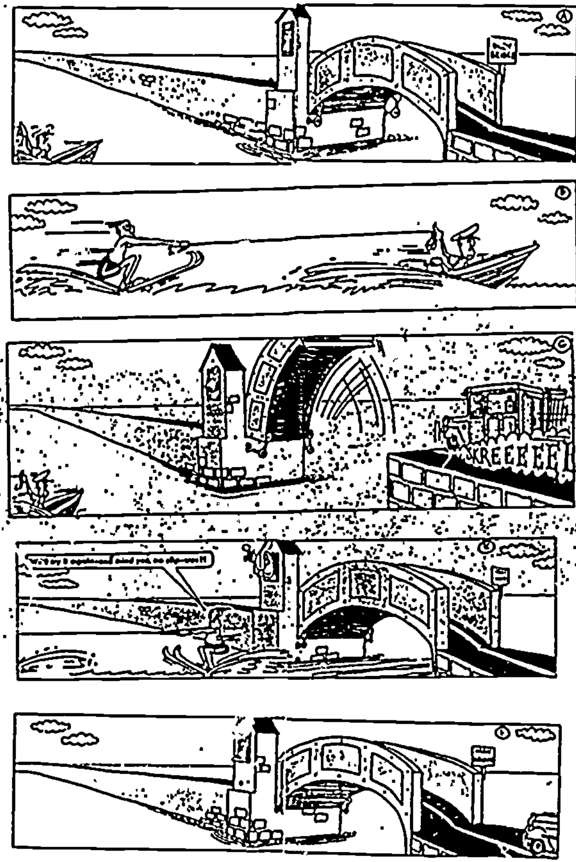

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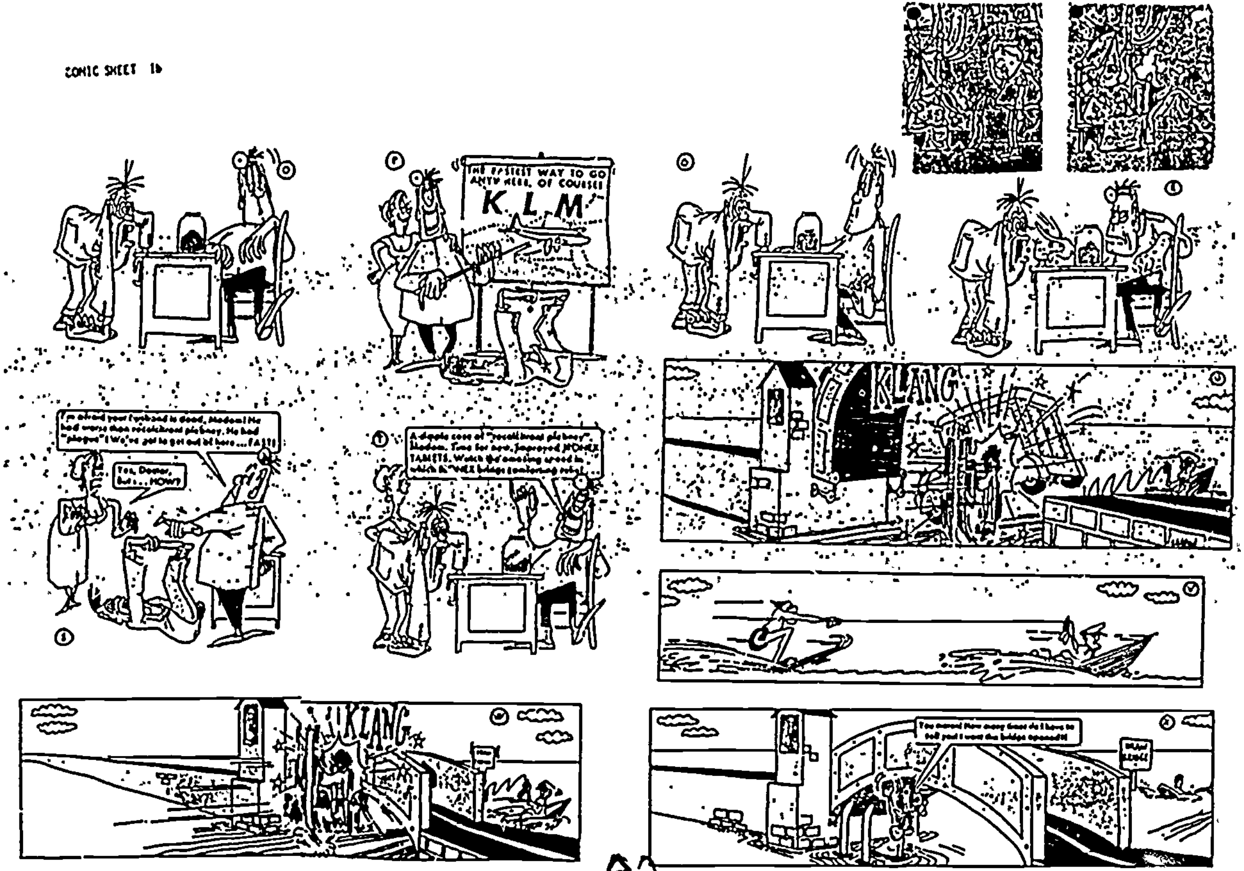

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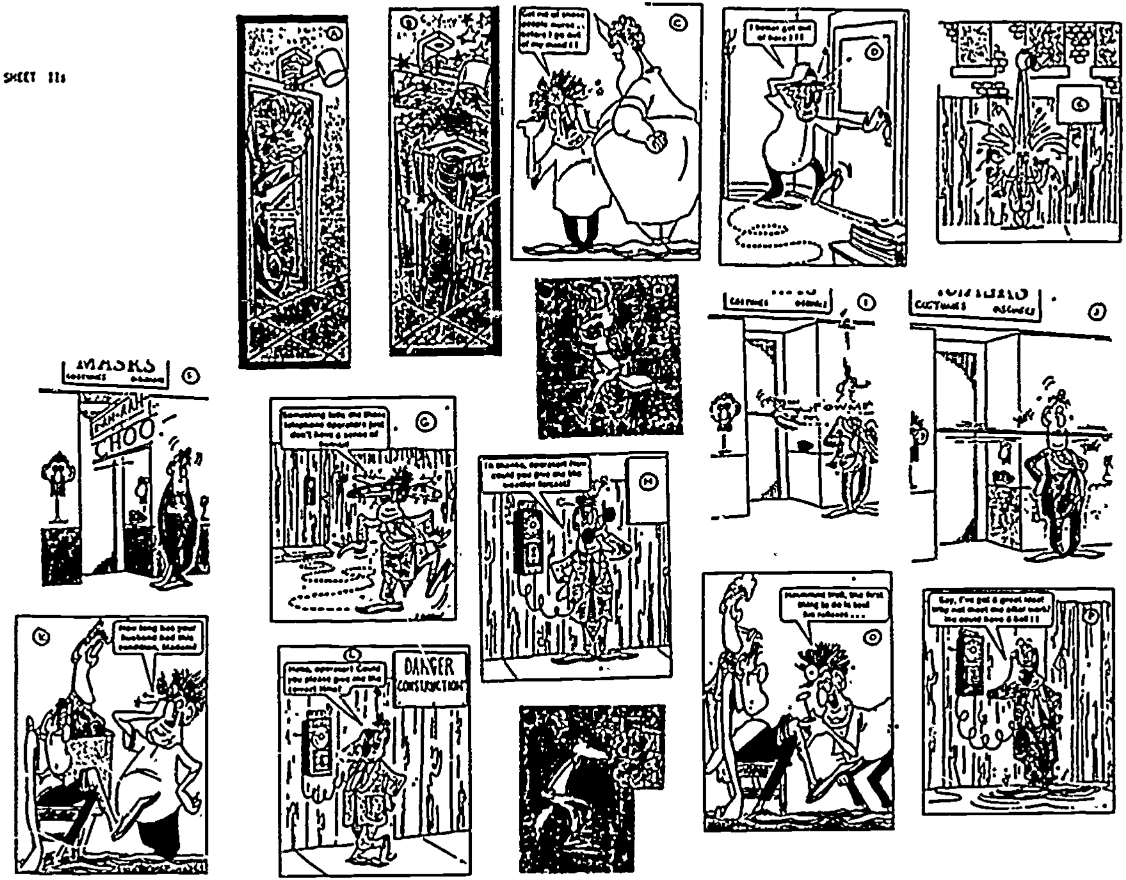

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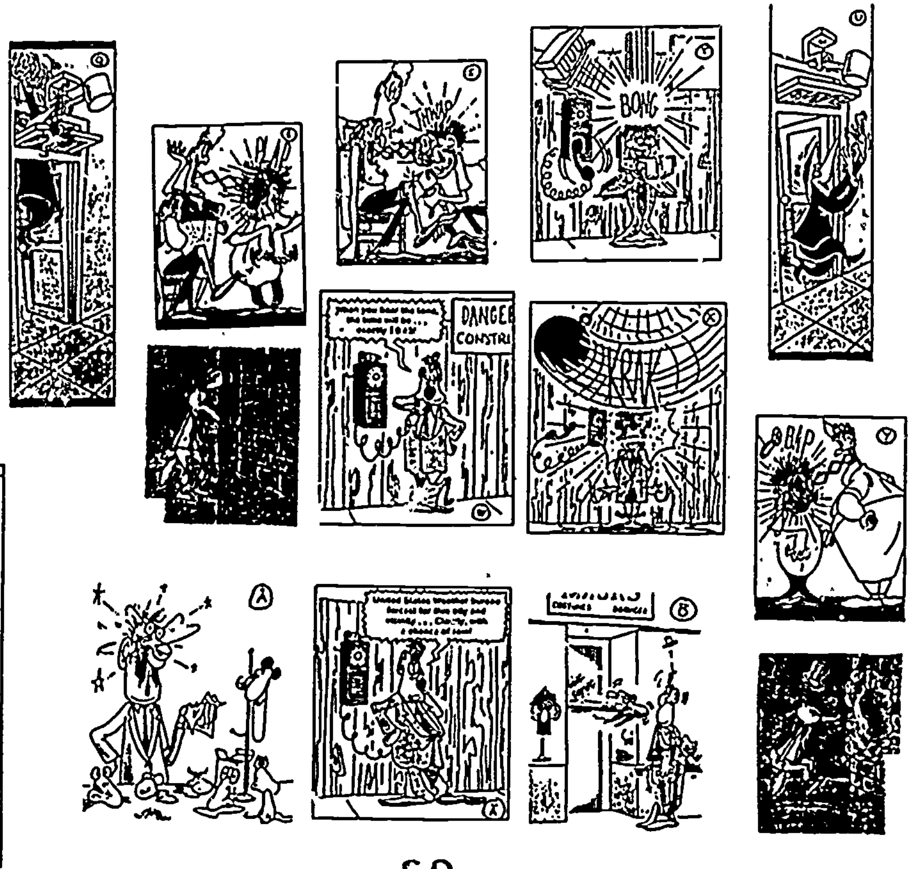

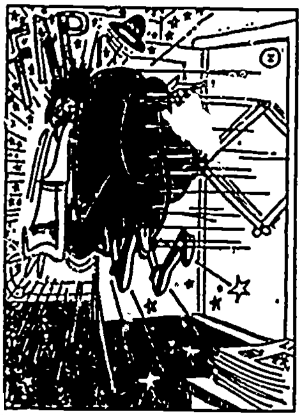

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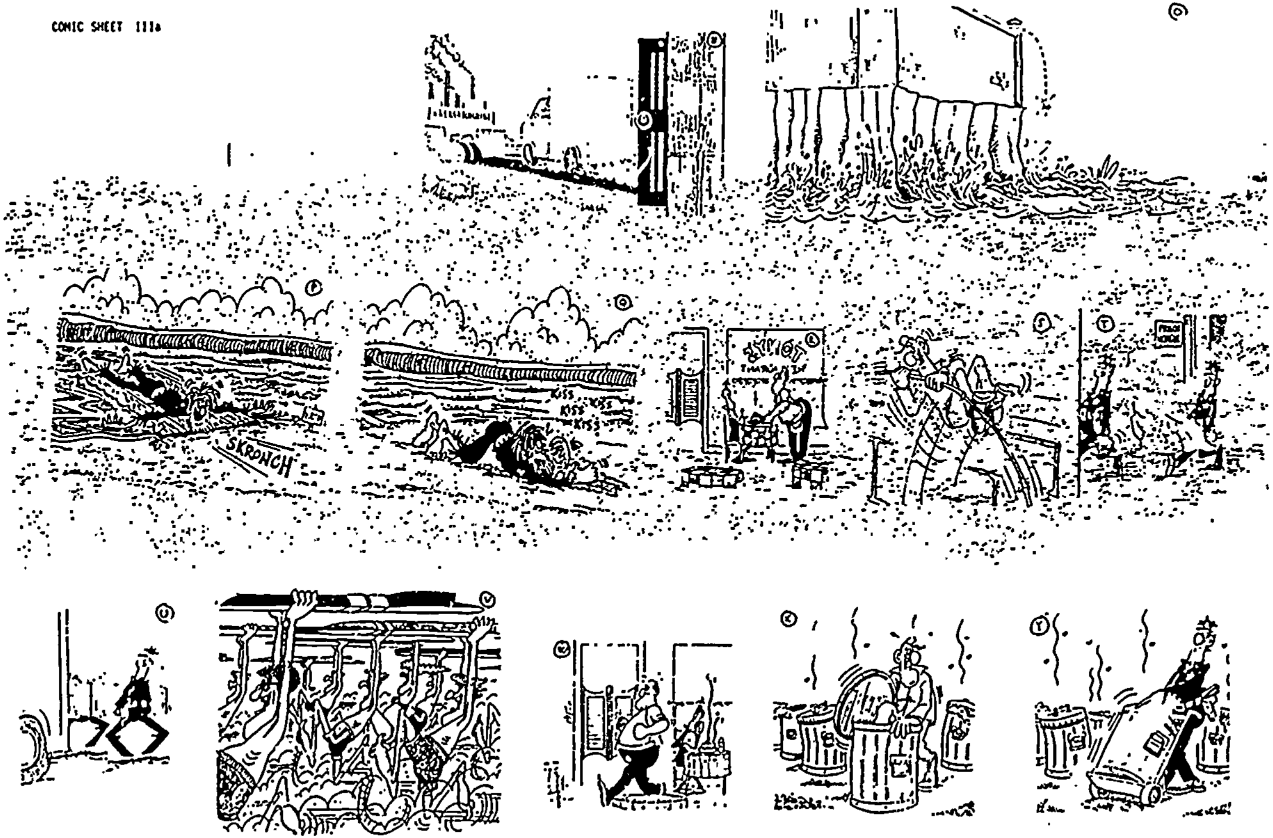

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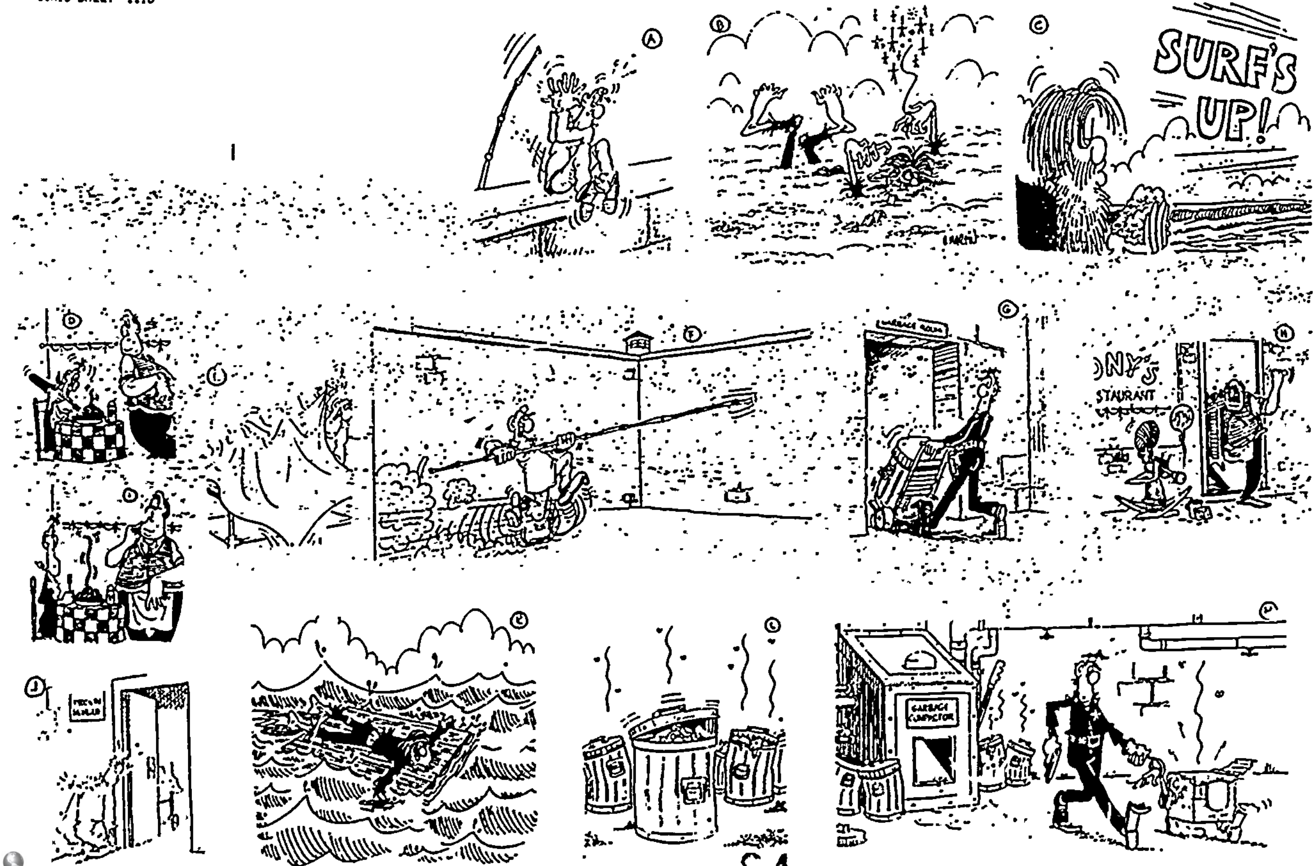

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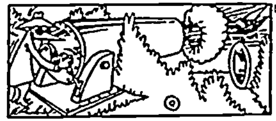

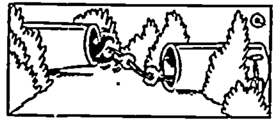

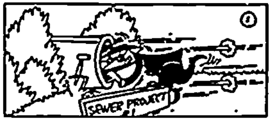

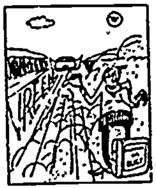

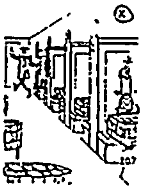

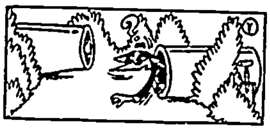

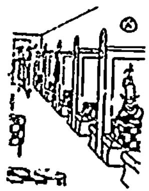

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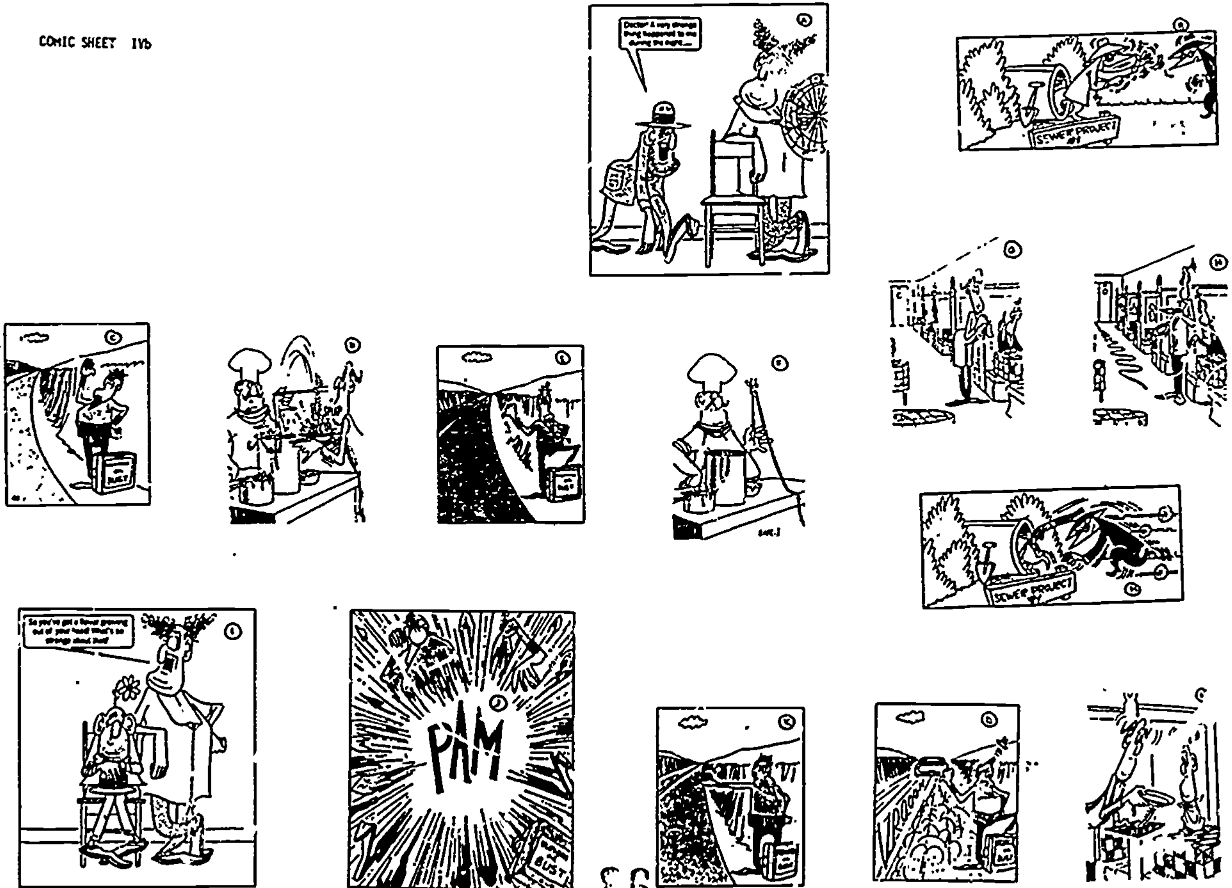

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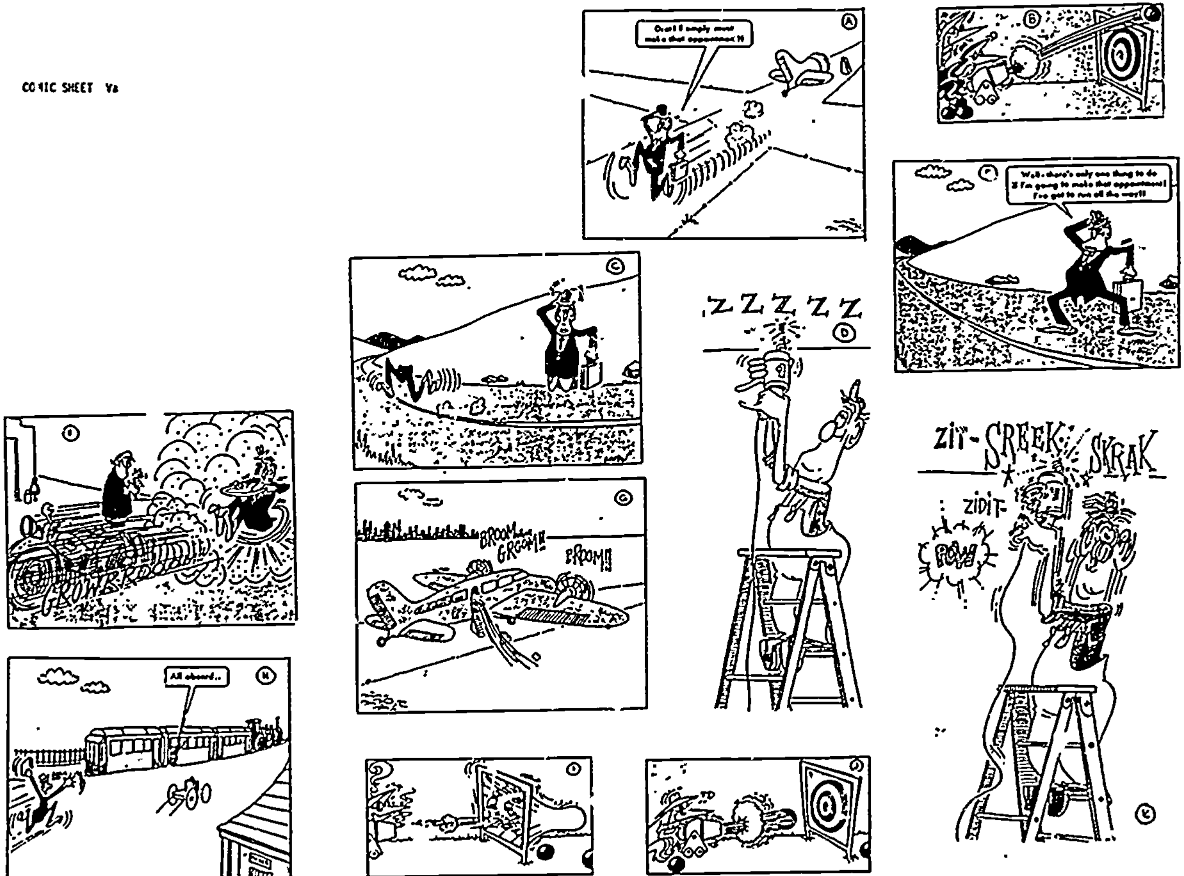

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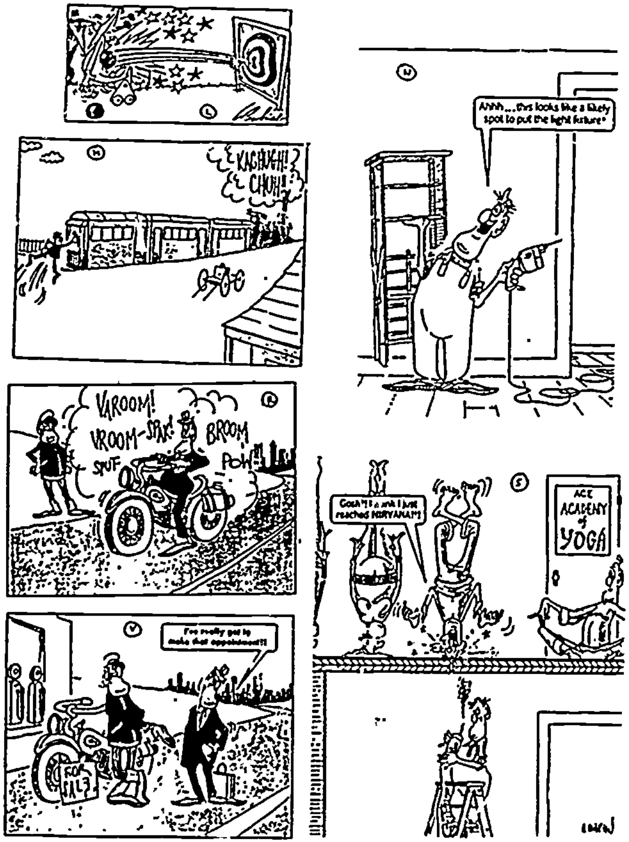

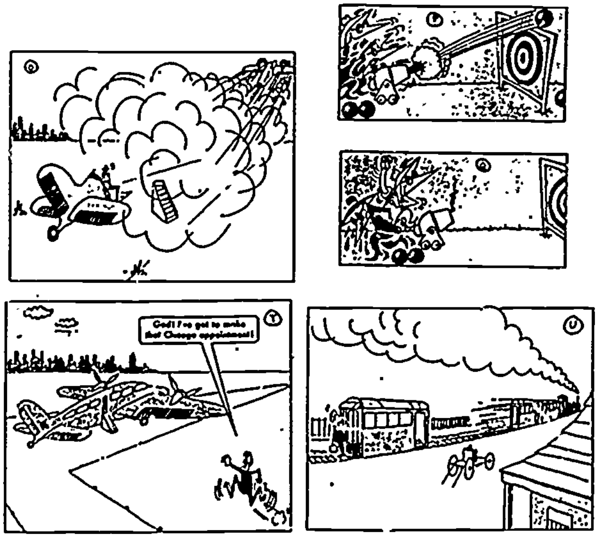

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Please, read the following instructions carefully before doing anything else!

INSTRUCTIONS

You and your partner each have a sheet of paper filled with comic strips cut into separate frames. Each cartoon is split so that both you and your partner have frames belonging to it.

Your task is to: 1) Figure out how many different comic strips these frames make up.
2) Figure out the right order of the frames to reconstruct the stories. Mark your suggestions on the Answer Sheet.

NOTE! -Your instructions are identical.
-It takes both your partners pictures and yours to reveal the stories so this is TEAM WORK.
-Your final suggestion for the correct order must be identical to your partners'.
-Same frame only occurs once.
-Your time will be limited to about 12 minutes.
-Do not write anything on the Comic Sheet.

When you have read these instructions say so. You will then receive further instructions. Take your time!

Please, do not make mechanical noises (whatsoever) as they will ruin the recording.

I thank you and Don Martin

Seppo Sneck

ADDRESS
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UNIVERSITY OF JYVÄSKYLÄ
DEPARTMENT OF COMMUNICATION

APPENDIX C - ANSWER SHEET

Name of participant: ______________________

Age in years: __________

Profession: ______________________

Place of birth: ______________________

Place of residence: ______________________

USA natives only:
Months in Finland: ______________________

Task 1. Number of different cartoons: __________ strips

Task 2. Frame orders (fill in the correct letters):

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) NAME: ______________________

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) NAME: ______________________

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) NAME: ______________________

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) NAME: ______________________

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) NAME: ______________________

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) NAME: ______________________

As you discuss the correct sequence of frames, suggest an appropriate title for each strip. Write this title after the word NAME above.

If you have any questions ask them now. Once you have lifted the receiver you will not be able to communicate with the experimenter.

ADDRESS
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APPENDIX D - CHRONOGRAPHICAL ANALYSIS OF EACH CONVERSATION

This appendix is divided into three sections, each containing the data of one conversation type. Section 1 shows the chronographical data of the 6 conversations where Finns talked to each other in Finnish.

Section 2 presents the analysis of the 8 intercultural conversations, ie. Finns talking to Americans in English.

Section 3 shows the second set of intracultural conversations, in which Americans talked to one another in English. Like section 1, this section consists of 6 conversations.

The chronographical analysis of each conversation consists of statistical data and a graphic representation of the conversation flow immediately below the statistics. The graphics data consists of 10 rectangles each representing 60 seconds of conversation time. In each rectangle there are four dotted lines. The upper two lines indicate the vocalizations of speakers 1 and 2, respectively. The two bottom lines show whose turn it is at each point of time.

The following abbreviations and symbols are used in the statistics output:

%	Percentage
x	Arithmetic mean
s	Standard deviation
#	Number of occurrences
Voc	Vocalization
Turn	Turn
SwP	Switching pause
Pause	Pause
Sim	Simultaneous speech (=interruptive + non-interruptive)
Int	Interruptive simultaneous speech
Ch	Channel

Additionally,

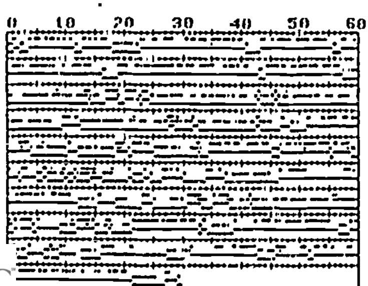
Vocal %	Vocalization percentage of conversation time (at least one person speaking)
Silence %	Total percentage of time when nobody spoke
S Pause %	Total switching pause percentage
Sim. sp %	Percentage of total time when more than one person was speaking

Section 1: Finn-Finn Conversations

STATISTICS Subjects 01 and 02
Total time 009:29.000
Time slice 009.29.500
Time range 000:00.000-009 29.500

	Ch1	Ch2	Ch3	Ch4
Voc %	34.94	29.85		
Voc x	1042	1056		
Voc s	822	875		
Turn #	61	62		
Turn x	5258	4012		
Turn s	6472	4849		
SwP #	44	40		
SwP x	1034	906		
SwP s	1018	765		
Pause %	30.79	24.00		
Pause x	724	580		
Pause s	818	414		
Sim #	22	18		
Sim %	1.49	1.49		
Int #	9	8		
Int %	0.79	0.57		

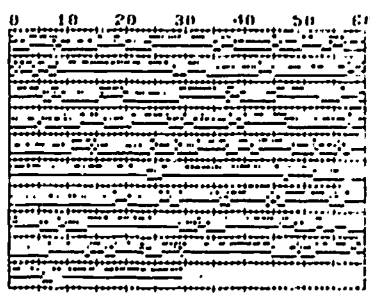
Vocal % 61.81 Silence % 38.19
S Pause % 14.35 Sim. sp % 2.99



STATISTICS Subjects 04 and 03
Total time 009 29.000
Time slice 009:29.250
Time range 000 00.000-009 29.250

	Ch1	Ch2	Ch3	Ch4
Voc %	28.63	21.65		
Voc x	840	616		
Voc s	685	497		
Turn #	65	65		
Turn x	4854	3896		
Turn s	5458	4144		
SwP #	51	48		
SwP x	1167	938		
SwP s	988	659		
Pause %	37.79	43.45		
Pause x	774	748		
Pause s	823	824		
Sim #	11	19		
Sim %	0.66	0.97		
Int #	6	5		
Int %	0.40	0.31		

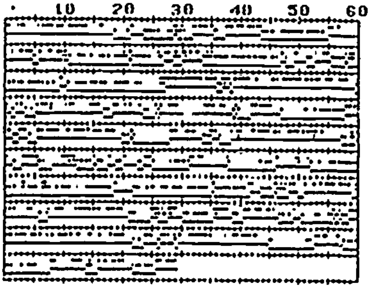
Vocal % 48.75 Silence % 51.25
S Pause % 18.36 Sim. sp % 1.54



STATISTICS — Subjects 03 and 01

	Ch1	Ch2	Ch3	Ch4
Total time	009:28.750			
Time slice	009:28.750			
Time range	000:00.000-009:28.750			
Voc %	31.74	27.03		
Voc x	885	899		
Voc s	790	763		
Turn #	67	66		
Turn x	4668	3879		
Turn s	5360	4706		
SwP #	48	46		
SwP x	865	848		
SwP s	658	944		
Pause %	36.87	32.14		
Pause x	800	758		
Pause s	782	880		
Sim #	22	18		
Sim %	1.63	1.14		
Int #	9	5		
Int %	0.70	0.35		

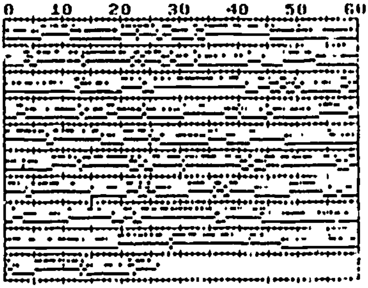
Vocal % 56.00 Silence % 44.00
S Pause % 14.15 Sim. sP % 2.77



STATISTICS — Subjects 02 and 04

	Ch1	Ch2	Ch3	Ch4
Total time	009:29.000			
Time slice	009:29.750			
Time range	000:00.000-009:29.750			
Voc %	27.62	26.96		
Voc x	859	798		
Voc s	713	755		
Turn #	64	64		
Turn x	42'4	4582		
Turn s	3679	5880		
SwP #	50	51		
SwP x	1005	1147		
SwP s	1006	808		
Pause %	32.21	36.42		
Pause x	675	701		
Pause s	523	616		
Sim #	17	12		
Sim %	1.02	0.57		
Int #	5	7		
Int %	0.27	0.35		

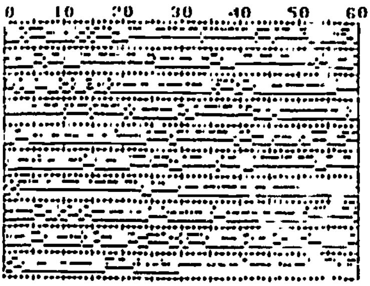
Vocal % 52.98 Silence % 47.0.
S Pause % 19.22 Sim. sP % 1.%



STATISTICS — Subjects 01 and 04

	Ch1	Ch2	Ch3	Ch4
Total time	012:47.000			
Time slice	009:29.500			
Time range	000:00.000-009:29.500			
Voc %	?6.73	32.31		
Voc x	851	913		
Voc s	586	915		
Turn #	76	77		
Turn x	3270	4169		
Turn s	3692	5469		
SwP #	62	58		
SwP x	669	953		
SwP s	493	731		
Pause %	29.35	32.17		
Pause x	633	750		
Pause s	699	1006		
Sim #	17	12		
Sim %	1.05	0.66		
Int #	10	1		
Int %	0.66	0.04		

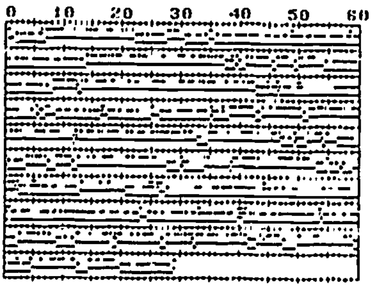
Vocal % 57.33 Silence % 42.67
S Pause % 16.99 Sim. sP % 1.71



STATISTICS — Subjects 03 and 02

	Ch1	Ch2	Ch3	Ch4
Total time	009:29.000			
Time slice	009:29.000			
Time range	000:00.000-009:29.000			
Voc %	28.47	33.88		
Voc x	786	1197		
Voc s	600	1055		
Turn #	52	51		
Turn x	5442	5603		
Turn s	6631	7878		
SwP #	32	39		
SwP x	836	667		
SwP s	758	536		
Pause %	40.20	27.24		
Pause x	736	667		
Pause s	659	731		
Sim #	21	13		
Sim %	1.54	0.66		
Int #	6	9		
Int %	0.35	0.48		

Vocal % 60.15 Silence % 39.85
S Pause % 9.27 Sim. sP % 2.20

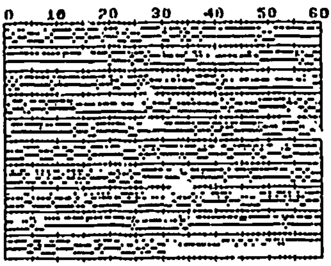


Section 2: Finn-American Conversations

STATISTICS — Subjects 12 and 01
Total time 011:06.500
Time slice 009:30.250
Time range 000:00.000-009:30.250

	Ch1	Ch2	Ch3	Ch4
Voc %	49.18	31.35		
Voc x	1099	805		
Voc s	942	601		
Turn #	114	114		
Turn x	3004	1998		
Turn s	3710	2580		
SuP #	57	58		
SuP x	[illegible]	522		
SuP s	341	375		
Pause %	16.45	18.48		
Pause x	458	420		
Pause s	395	306		
Sim #	37	48		
Sim %	2.10	3.11		
Int #	14	26		
Int %	0.70	1.49		

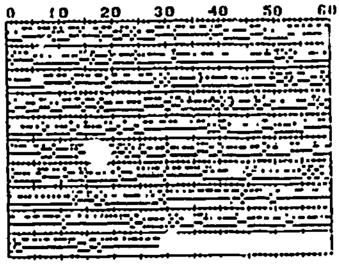
Vocal % 74.31 Silence % 25.69
S Pause % 10.21 Sim. sP % 5.22



STATISTICS — Subjects 02 and 13
Total time 009:29.000
Time slice 009:28.250
Time range 000:00.000-009:28.250

	Ch1	Ch2	Ch3	Ch4
Voc %	27.67	33.30		
Voc x	675	819		
Voc s	400	601		
Turn #	99	99		
Turn x	2571	3169		
Turn s	3352	3385		
SuP #	65	62		
SuP x	558	661		
SuP s	414	481		
Pause %	[illegible].88	32.08		
Pause x	598	706		
Pause s	[illegible]	579		
Sim #	30	16		
Sim %	1.89	0.70		
Int #	15	8		
Int %	0.92	0.35		

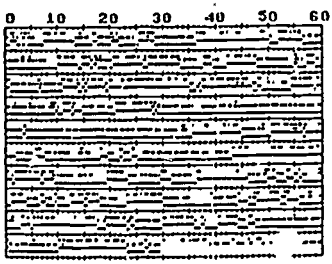
Vocal % 58.38 Silence % 41.62
S Pause % 13.59 Sim. sP % 2.60



STATISTICS — Subjects 03 and 14
Total time 010:54.500
Time slice 009:29.250
Time range 000:00.000-009:29.250

	Ch1	Ch2	Ch3	Ch4
Voc %	27.89	40.45		
Voc x	786	1112		
Voc s	514	1016		
Turn #	73	74		
Turn x	3428	4311		
Turn s	3338	5489		
SuP #	47	53		
SuP x	596	708		
SuP s	474	530		
Pause %	35.43	20.52		
Pause x	736	458		
Pause s	687	420		
Sim #	36	16		
Sim %	2.[illegible]8	1.14		
Int #	14	8		
Int %	0.92	0.53		

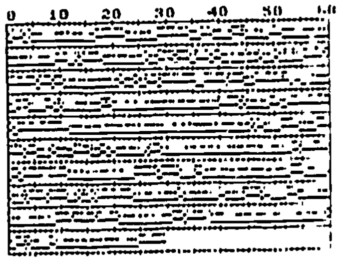
Vocal % 64.51 Silence % 35.49
S Pause % 11.51 Sim. sP % 3.82



STATISTICS — Subjects 11 and 04
Total time 009:29.0[illegible]
Time slice 009:29.500
Time range 000:00.000-009:29.500

	Ch1	Ch2	Ch3	Ch4
Voc %	25.07	38.50		
Voc x	763	761		
Voc s	562	581		
Turn #	84	84		
Turn x	2467	4313		
Turn s	2044	6189		
SuP #	63	51		
SuP x	393	642		
SuP s	253	485		
Pause %	26.16	34.29		
Pause x	513	562		
Pause s	366	417		
Sim #	27	8		
Sim %	1.40	0.48		
Int #	17	5		
Int %	0.83	0.22		

Vocal % 61.68 Silence % 38.32
S Pause % 10.10 Sim. sP % 1.89



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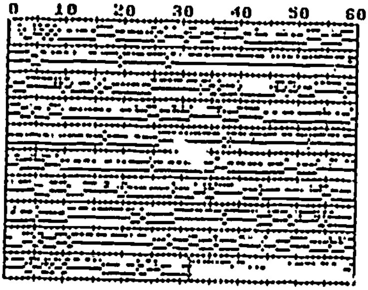
STATISTICS — Subjects 12 and 11

Total time 015:56.250
Time slice 009:31.750
Time range 000:00.000-009:31.750

	Ch1	Ch2	Ch3	Ch4
Voc %	36.82	37.39		
Voc x	1007	1048		
Voc s	864	836		
Turn #	78	78		
Turn x	3600	3647		
Turn s	4424	3792		
SuP #	49	42		
SuP x	612	476		
SuP s	439	382		
Pause %	22.11	22.87		
Pause x	504	565		
Pause s	400	561		
Sim #	31	29		
Sim %	2.01	1.71		
Int #	11	9		
Int %	0.66	0.48		

Vocal % 70.53 Silence % 29.47
S Pause % 8.75 Sim. sP % 3.67

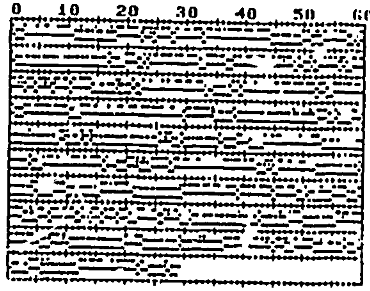


STATISTICS — Subjects 13 and 14

Total time 009:29.000
Time slice 009:28.750
Time range 000:00.000-009:28.750

	Ch1	Ch2	Ch3	Ch4
Voc %	36.92	36.73		
Voc x	875	1142		
Voc s	599	1109		
Turn #	93	93		
Turn x	3296	2817		
Turn s	3508	3134		
SuP #	56	60		
SuP x	451	500		
SuP s	339	380		
Pause %	29.16	12.18		
Pause x	661	362		
Pause s	591	208		
Sim #	34	17		
Sim %	1.89	0.92		
Int #	11	4		
Int %	0.57	0.22		

Vocal % 70.90 Silence % 29.10
S Pause % 9.71 Sim. sP % [illegible]

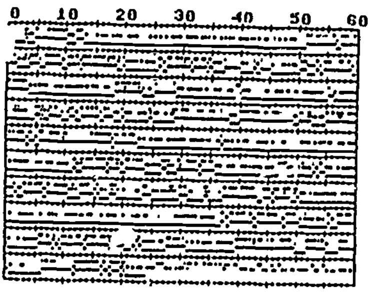


STATISTICS — Subjects 11 and 13

Total time 012:13.000
Time slice 009:24.000
Time range 000:00.000-009:24.000

	Ch1	Ch2	Ch3	Ch4
Voc %	27.88	38.52		
Voc x	828	909		
Voc s	620	764		
Turn #	88	88		
Turn x	2625	3784		
Turn s	2406	7543		
SuP #	64	59		
SuP x	456	593		
SuP s	509	508		
Pause %	24.47	28.94		
Pause x	524	625		
Pause s	525	475		
Sim #	21	14		
Sim %	1.20	0.98		
Int #	12	1		
Int %	0.66	0.13		

Vocal % 64.23 Silence % 35.77
S Pause % 11.84 Sim. sP % 2.17

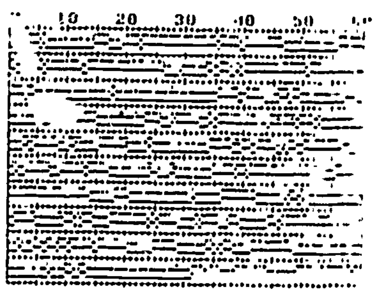


STATISTICS — Subjects 12 and 14

Total time 010:11.000
Time slice 009:31.500
Time range 000:00.000-009:31.500

	Ch1	Ch2	Ch3	Ch4
Voc %	38.54	41.34		
Voc x	933	1250		
Voc s	791	1159		
Turn #	100	100		
Turn x	2860	2855		
Turn s	3223	3593		
SuP #	53	51		
SuP x	443	500		
SuP s	284	497		
Pause %	20.00	11.54		
Pause x	445	375		
Pause s	390	232		
Sim #	31	20		
Sim %	1.79	1.09		
Int #	12	11		
Int %	0.61	0.57		

Vocal % 76.99 Silence % 23.01
S Pause % 8.57 Sim. sP % 2.89

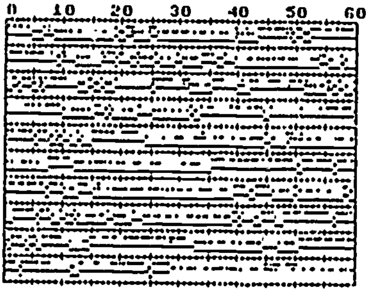


Section 3: American-American Conversations

STATISTICS		Subjects 11 and 01
Total time		010:16.500
Time slice		009:28.250
Time range		000:00.000-009:28.250

	Ch1	Ch2	Ch3	Ch4
Voc %	30.09	2?.44		
Voc x	886	729		
Voc s	655	435		
Turn #	77	76		
Turn x	3718	3711		
Turn s	4132	5368		
SwP #	61	65		
SwP x	820	696		
SwP s	845	556		
Pause %	29.10	38.23		
Pause x	637	730		
Pause s	676	586		
Sim #	12	13		
Sim %	0.62	0.70		
Int #	3	7		
Int %	0.13	0.35		

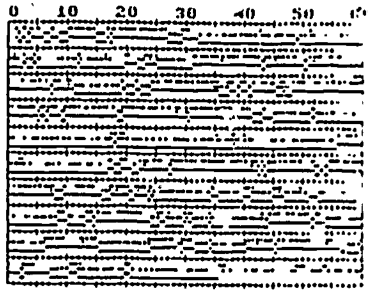
Vocal %	55.21	Silence %	44.79
S Pause %	16.76	Sim. sP %	1.32



STATISTICS		Subjects 12 and 0[illegible]
Total time		014:38.[illegible]
Time slice		009:35.5[illegible]
Time range		000:00.000-009:35.5[illegible]

	Ch1	Ch2	Ch3	Ch4
Voc %	34.19	37.36		
Voc x	932	927		
Voc s	729	709		
Turn #	73	73		
Turn x	3743	4127		
Turn s	4301	5403		
SwP #	45	24		
SwP x	683	438		
SwP s	498	278		
Pause %	24.12	29.[illegible]		
Pause x	483	[illegible]93		
Pause s	578	533		
Sim #	39	23		
Sim %	2.22	1.56		
Int #	22	7		
Int %	1.30	0.48		

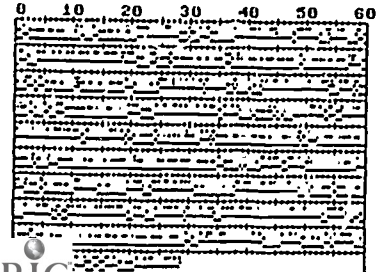
Vocal %	67.77	Silence %	32.2[illegible]
S Pause %	7.17	Sim. sP %	3.70



STATISTICS		Subjects 03 and 13
Total time		009:29.000
Time slice		009:28.250
Time range		000:00.000-009:28.250

	Ch1	Ch2	Ch3	Ch4
Voc %	22.35	28.86		
Voc x	577	777		
Voc s	337	543		
Turn #	84	84		
Turn x	3205	3560		
Turn s	3762	4663		
SwP #	65	58		
SwP x	688	780		
SwP s	622	489		
Pause %	46.44	36.95		
Pause x	841	775		
Pause s	816	625		
Sim #	25	12		
Sim %	1.19	0.70		
Int #	12	6		
Int %	0.53	0.35		

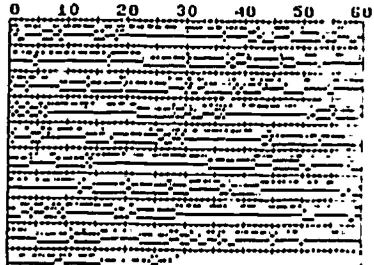
Vocal %	49.32	Silence %	50.68
S Pause %	15.84	Sim. sP %	1.89



STATISTICS		Subjects 04 and 1[illegible]
Total time		009:2[illegible]
Time slice		009:[illegible]
Time range		000:00.000-009:[illegible]

	Ch1	Ch2	Ch3	Ch4
Voc %	38.28	33.22		
Voc x	785	1097		
Voc s	551	971		
Turn #	88	88		
Turn x	3818	2634		
Turn s	4825	2286		
SwP #	53	46		
SwP x	519	484		
SwP s	444	331		
Pause %	33.31	13.25		
Pause x	591	[illegible]85		
Pause s	599	[illegible]48		
Sim #	32	20		
Sim %	2.07	1.23		
Int #	17	8		
Int %	0.92	0.40		

Vocal %	68.28	Silence %	31.72
S Pause %	8.75	Sim. sP %	3.21



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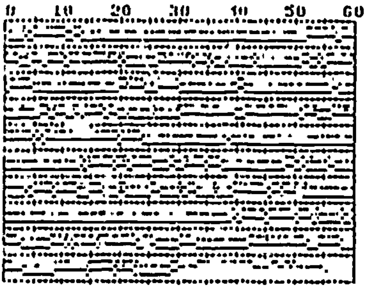
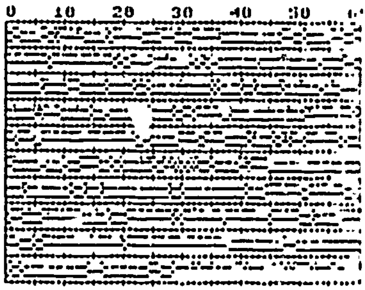
STATISTICS		Subjects 11 and 14		
Total time		009:28.250		
Time slice		009:26.250		
Time range		000 00.000-009 26.250		
	Ch1	Ch2	Ch3	Ch4
Voc %	31.26	30.24		
Voc x	876	758		
Voc s	841	530		
Turn #	7?	76		
Turn x	3627	3773		
Turn s	4090	4225		
SuP #	55	53		
SuP x	932	552		
SuP s	501	471		
Pause %	23.90	34.85		
Pause x	470	615		
Pause s	434	529		
Sim #	13	14		
Sim %	0.62	0.62		
Int #	4	10		
Int %	0.22	0.44		
Vocal %	60.26	Silence %	39.74	
S Pause %	14.22	Sim. sP %	1.24	



STATISTICS		Subjects 13 and 1?		
Total time		009:5?.2??		
Time slice		009:28.500		
Time range		000 00.000-009 28.500		
	Ch1	Ch2	Ch3	Ch4
Voc %	31.27	50.13		
Voc x	797	1549		
Voc s	586	1270		
Turn #	104	104		
Turn x	2346	3120		
Turn s	3112	2929		
SuP #	62	44		
SuP x	500	386		
SuP s	395	232		
Pause %	22.54	9.35		
Pause x	511	389		
Pause s	474	265		
Sim #	40	21		
Sim %	2.24	1.10		
Int #	14	15		
Int %	0.79	0.79		
Vocal %	78.06	Silence %	21.94	
S Pause %	8.44	Sim. sP %	3.34	



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Conversation 1

Measurement 1

Time slice 001:00.000
Time range 000:00.000-001:00.000

	Ch1	Ch2	Ch3	Ch4
Voc %	31.25	41.67		
Voc x	933	701		
Voc s	1070	554		
Turn #	12	11		
Turn x	2021	3091		
Turn s	1532	3154		
SuP #	8	5		
SuP x	594	350		
SuP s	462	224		
Pause %	12.82	27.13		
Pause x	625	517		
Pause s	323	369		
Sim #	6	6		
Sim %	2.92	2.50		
Int #	2	1		
Int %	0.83	0.42		

Vocal %	67.92	Silence %	32.08
S Pause %	10.83	Sim. sP %	5.00

Measurement 2

Time slice 001:00.000
Time range 000:00.000-001:00.000

	Ch1	Ch2	Ch3	Ch4
Voc %	30.42	42.08		
Voc x	961	815		
Voc s	1094	555		
Turn #	11	10		
Turn x	2159	3450		
Turn s	1526	3412		
SuP #	8	5		
SuP x	594	350		
SuP s	462	224		
Pause %	13.16	26.72		
Pause x	625	547		
Pause s	323	368		
Sim #	6	5		
Sim %	2.92	2.08		
Int #	2	0		
Int %	0.83	0.00		

Vocal %	67.92	Silence %	32.08
S Pause %	10.83	Sim. sP %	4.58

Measurement 3

STATISTICS
Total time 015:43.250
Time slice 001:00.000
Time range 000:00.000-001:00.000

	Ch1	Ch2	Ch3	Ch4
Voc %	34.17	42.08		
Voc x	1367	902		
Voc s	1267	629		
Turn #	10	10		
Turn x	2625	3350		
Turn s	1916	3496		
SuP #	7	4		
SuP x	893	313		
SuP s	977	125		
Pause %	6.25	24.03		
Pause x	313	517		
Pause s	315	372		
Sim #	4	3		
Sim %	2.92	1.25		
Int #	2	0		
Int %	1.67	0.00		

Vocal %	72.08	Silence %	27.92
S Pause %	12.50	Sim. sP %	4.17

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Conversation 2

Time slice		001:00.000		
Time range		000:00.000-001:00.000		
	Ch1	Ch2	Ch3	Ch4
Voc %	31.67	25.00		
Voc x	760	1000		
Voc s	663	954		
Turn #	7	6		
Turn x	5179	3958		
Turn s	6050	3976		
SuP #	3	4		
SuP x	1167	938		
SuP s	804	554		
Pause %	42.75	27.50		
Pause x	778	611		
Pause s	790	517		
Sim #	1	1		
Sim %	0.42	0.83		
Int #	2	1		
Int %	5.42	0.83		
Vocal %	55.42	Silence %	44.58	
S Pause %	12.08	Sim. sP %	1.25	

Measurement 1

Time slice		001:00.000		
Time range		000:00.000-001:00.000		
	Ch1	Ch2	Ch3	Ch4
Voc %	31.67	25.42		
Voc x	760	953		
Voc s	663	941		
Turn #	7	6		
Turn x	5107	4042		
Turn s	5873	3957		
SuP #	3	4		
SuP x	1000	938		
SuP s	750	554		
Pause %	42.75	28.05		
Pause x	778	575		
Pause s	790	501		
Sim #	1	1		
Sim %	0.42	0.83		
Int #	2	1		
Int %	5.42	0.83		
Vocal %	55.83	Silence %	44.17	
S Pause %	11.25	Sim. sP %	1.25	

Measurement 2

Time slice		001:00.000		
Time range		000:00.000-001:00.000		
	Ch1	Ch2	Ch3	Ch4
Voc %	32.92	26.25		
Voc x	823	1125		
Voc s	657	979		
Turn #	7	6		
Turn x	5179	3958		
Turn s	6050	3976		
SuP #	3	3		
SuP x	1167	1167		
SuP s	804	382		
Pause %	41.22	24.69		
Pause x	794	625		
Pause s	811	482		
Sim #	2	1		
Sim %	0.83	0.83		
Int #	3	1		
Int %	5.83	0.83		
Vocal %	57.50	Silence %	42.50	
S Pause %	11.67	Sim. sP %	1.67	

Measurement 3

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Conversation 3

Measurement 1

Time slice 001:00.000
Time range 000:00.000-001:00.000

	Ch1	Ch2	Ch3	Ch4
Voc %	50.42	26.25		
Voc x	917	793		
Voc s	678	699		
Turn #	12	11		
Turn x	3417	1682		
Turn s	4722	1304		
SuP #	7	4		
SuP x	321	563		
SuP s	122	375		
Pause %	25.16	13.85		
Pause x	488	375		
Pause s	333	345		
Sim #	3	4		
Sim %	2.08	2.92		
Int #	2	1		
Int %	2.50	0.42		

Vocal %	72.50	Silence %	27.50
S Pause %	7.50	Sim. sP %	4.17

Measurement 2

Time slice 001:00.000
Time range 000:00.000-001:00.000

	Ch1	Ch2	Ch3	Ch4
Voc %	50.42	26.67		
Voc x	890	762		
Voc s	669	691		
Turn #	13	12		
Turn x	3135	1560		
Turn s	4610	1310		
SuP #	7	4		
SuP x	321	563		
SuP s	122	375		
Pause %	24.60	13.64		
Pause x	475	375		
Pause s	343	345		
Sim #	3	4		
Sim %	2.08	2.92		
Int #	2	1		
Int %	2.50	0.42		

Vocal %	72.92	Silence %	27.08
S Pause %	7.50	Sim. sP %	4.17

Measurement 3

Time slice 001:00.000
Time range 000:00.000-001:00.000

	Ch1	Ch2	Ch3	Ch4
Voc %	49.17	25.83		
Voc x	922	816		
Voc s	640	706		
Turn #	11	1.		
Turn x	3636	1773		
Turn s	4889	1306		
SuP #	7	3		
SuP x	321	500		
SuP s	122	433		
Pause %	25.17	22.22		
Pause x	475	667		
Pause s	371	606		
Sim #	3	3		
Sim %	2.08	2.50		
Int #	2	1		
Int %	1.25	0.42		

Vocal %	71.25	Silence %	28.75
S Pause %	6.25	Sim. sP %	3.75

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Conversation 4

Measurement 1

Time slice 001:00.000
Time range 000:00.000-001:00.000

	Ch1	Ch2	Ch3	Ch4
Voc %	20.00	27.08		
Voc x	522	677		
Voc s	482	445		
Turn #	11	12		
Turn x	2727	2500		
Turn s	3145	2726		
SwP #	9	9		
SwP x	972	722		
SwP s	723	458		
Pause %	47.06	31.91		
Pause x	1000	682		
Pause s	943	476		
Sim #	3	1		
Sim %	1.25	0.42		
Int #	1	1		
Int %	0.42	0.42		

Vocal % 45.42 Silence % 54.58
S Pause % 25.42 Sim. sP % 1.67

Measurement 2

Time slice 001:00.000
Time range 000:00.000-001:00.000

	Ch1	Ch2	Ch3	Ch4
Voc %	20.42	27.50		
Voc x	510	660		
Voc s	475	444		
Turn #	12	13		
Turn x	2521	2238		
Turn s	3083	2516		
SwP #	9	9		
SwP x	972	722		
SwP s	723	458		
Pause %	46.51	31.13		
Pause x	1000	725		
Pause s	943	478		
Sim #	3	2		
Sim %	1.25	0.83		
Int #	1	1		
Int %	0.42	0.42		

Vocal % 45.83 Silence % 54.17
S Pause % 25.42 Sim. sP % 2.08

Measurement 3

Time slice 001:00.000
Time range 000:00.000-001:00.000

	Ch1	Ch2	Ch3	Ch4
Voc %	18.33	27.08		
Voc x	500	677		
Voc s	463	457		
Turn #	11	12		
Turn x	2727	2500		
Turn s	3145	2726		
SwP #	9	9		
SwP x	1111	722		
SwP s	686	458		
Pause %	47.50	31.91		
Pause x	950	682		
Pause s	956	501		
Sim #	2	1		
Sim %	0.83	0.42		
Int #	1	1		
Int %	0.42	0.42		

Vocal % 44.17 Silence % 55.83
S Pause % 27.50 Sim. sP % 1.25

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